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POLLUTION OF THE INTERSTATE WATERS OF THE LOWER MISSISSIPPI RIVER. PROCEEDINGS OF CONFERENCE HELD AT NEW ORLEANS, LOUISIANA ON MAY 5-6, 1964. VOLUME III

Public Health Service
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6 May 1964

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CONFERENCE

in the matter of

Pollution of the Interstate Waters of the

LOWER MISSISSIPPI RIVER

PROCEEDINGS

Volume III

May 5-6, 1964
New Orleans, Louisiana

U.S. Department of Health, Education, and Welfare
Washington, D.C.

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Conference in the Matter of Pollution of the Interstate Waters of the Lower Mississippi River (Arkansas-Tennessee-Mississippi-Louisiana) convened at 8:30 a.m., on Wednesday, May 6, 1964, in Room T-13028, Federal Office Building, 701 Loyola Avenue, New Orleans, Louisiana.

PRESIDING:

Mr. Murray Stein, Chief, Enforcement Branch, Water Supply and Pollution Control, Public Health Service, Department of Health, Education, and Welfare, Washington 25, D. C.

PRESENT:

(As noted in the transcript of May 5, 1964.)

PROCEEDINGS

MR. STEIN: May we reconvene?

Mr. Richard N. Deed of Arkansas is the co-conferee for Arkansas today.

At this point we will call on the State of Tennessee. Mr. Jones?

MR. JONES: I think we might as well get down to business.

To clarify one point that was made yesterday, we agreed wholeheartedly with the idea of the conference. We have had them in Tennessee since the law was passed in 1945. We have fooled around in Tennessee with conferences with industries and cities since 1956. I believe any pollution problem can be cleared up in that way.

Our argument yesterday was not about the way you are conducting this conference, Murray, but the fact that we did not get enough straight facts to start with to get into a true conference to solve something.

There is a lot of conflicting data. It is going to take a long time to unravel. We will have as much trouble unraveling it as perhaps the reporter might understanding some of the mess that has been put into the record.

We will not have many people from Tennessee talking. We have two representatives from our Tennessee

Game and Fish Commission, Mr. Stubbs and Mr. Goodrich. Mr. John Stubbs from the Tennessee Game and Fish Commission and Mr. Dave Goodrich, Assistant Director of the Tennessee Game and Fish Commission, might come up and we will get the show on the road.

STATEMENT OF JOHN M. STUBBS, SUPERVISOR OF POLLUTION CONTROL AND WARM WATER STREAMS FOR THE TENNESSEE STREAM COMMISSION

MR. STUBBS: Mr. Chairman and members of the conference --

MR. JONES: Excuse me. For the record, put your full name and title into the record, please?

MR. STUBBS: All right, sir. My name is John M. Stubbs and I am Supervisor of Pollution Control and Warm Water Streams for the Tennessee Stream Commission.

Due to a previous engagement, Mr. Fred Stanbury, Director of the Tennessee Game Commission, is unable to be here today, but the Assistant Director, Mr. David Goodrich, is here in the audience.

I appreciate the opportunity to be here today to discuss a matter about which we of the Tennessee Game and

Fish Commission are deeply concerned.

During the past three years the State of Tennessee has had several instances of fish and wildlife killed from the indiscriminate use of agricultural poisons. All of the kills we have had were connected with the use of Dieldrin. Listed below are the kills that have been directly related to the use of Dieldrin.

1. Spring Creek - Hardeman County - March 24, 1961. Approximately 3,400 acres were treated with ten percent Dieldrin in granulated form, and was applied by aerial application at the rate of 30 pounds per acre. The following lists are of animals that were found dead resulting from this treatment.

BIRDS

Dove	2	Cardinal	4
Quail	22	Robin	1
Flicker	2	Bluebird	2
Olive-back Thrush	2	Brown Thrasher	6
White-throated Sparrow	5	Grackle	2
Field Sparrow	1	Screech Owl	1
English Sparrow	1	Blue Jay	8
Junco	16		

Three (3) sick rabbits and several sick birds were observed.

MAMMALS

Cottontail rabbits	19
Deer mice	2

REPTILES AND AMPHIBIANS

Blue Racer snake (sick)	1
Diamond-back water snake (sick)	1
Small bull frog	1
Leopard frog	2

FISH AND CRUSTACEANS

Bluegill	7
Largemouth bass	2
Bullhead catfish	6
Buffalo	3
Creek Chub minnow	10
Crayfish	Unc.
Pickerel	2
Golden shiner	3
Sunfish	22
Crappie, black	1

Dr. James B. DeWitt, Chief, Section of Chemical and Physiological Studies, Patuxent Wildlife Research Center, examined these specimens and made the following statement:

J. M. Stubbs

"The above specimens contained Dieldrin in concentrations equal to those in birds and mammals found dead in other areas which had been treated with this insecticide, and it appeared that these animals had absorbed appreciable quantities of Dieldrin shortly before death."

2. Fillauer Branch - Bradley County - February 2, 1962. One-thousand-five-hundred (1,500) acres in and near the north end of Bradley County were treated with Dieldrin to combat an infestation of white fringe beetle. Application was made by airplane dusting at the rate of 30 pounds per acre of ten percent Dieldrin in granular form. The following list is of animals that were found dead resulting from this treatment:

Sculpins
Shiners
Dace
Hogsuckers
Crayfish
Carp

The number of these fish found dead is unknown.

3. Steekee Creek - Loudon County - March, 1962. Treatment of 54,000 acres was made in Loudon County beginning March 12 and was applied at the rate of three

pounds per acre of Dieldrin. It was reported that all fish life, including crayfish and salamanders, were eliminated from Steekee Creek. Many dead minnows of various species, hogsuckers, largemouth bass, smallmouth bass, rock bass, and bluegill were found dead during this inspection trip. Many dead birds, which included bluebirds, bluejays, juncoes, mockingbirds, cardinals, and at least two species of sparrows were found dead. The only mammals found were several dead rabbits.

4. Beaver Dam Creek - Johnson County - May 22, 1962. Approximately 800 acres in the Grandull area of Johnson County were sprayed with ten percent Dieldrin at the rate of two pounds per acre. Fish mortality began downstream from the treated area on the first day of insecticide application and continued for four days. The dead and dying fish were counted within six sample areas, totaling 3,300 feet. Thirty-two game species and 1,065 forage fish were found. These figures projected for the 6.3 miles within the managed area are 345 game species and 11,500 forage fish killed. Game fish recovered were rainbow and brown trout, excepting three smallmouth bass. Forage species killed included whitetail shiners, stonerollers, blacknose dace,

southern redbelly dace, warpaint shiners, mottled soulpins, and darter spp. The only rough fish observed were black suckers.

As a result of the nearly complete decimation of the resident fish population, a possible public health hazard and expected delayed mortality following heavy rainfall, Beaver Dam Creek was closed to public fishing for the remainder of the 1962 season. The planned stocking level for the season was 14,500 adult trout. Using the national average of $5.36 per recreational angler day, local expenditures in 1961 were $17,184.00. This value under normal circumstances should have been $20,300.00 for 1962.

5. Community of Loretto - Lawrence County - Fall of 1962.

Several local pond owners were located within a watershed that was sprayed with granulated Dieldrin at the rate of three pounds per acre. Two-thousand-five-hundred (2,500) channel catfish, 40,000 bluegill, 5,000 largemouth bass, and 8,000 minnows were killed due to the aerial application of Dieldrin.

These local pond owners are now in the process of trying to collect damages from the State of Tennessee and have filed a suit against the Department of Agriculture.

MR. STEIN: Pardon me. For clarification, is that the Department of Agriculture of the State of Tennessee, or of the United States?

MR. STUBBS: It is the Department of Agriculture of the State of Tennessee.

MR. STEIN: Thank you.

MR. STUBBS: The above heavy loss of fish and wildlife can be attributed to accidental spillage, careless spraying operations, heavy rains, and run-off shortly after the chemicals have been applied.

In March of 1963, the Tennessee Game and Fish Commission became the nation's first such organization to enter into a pesticide coordination agreement with the Tennessee Department of Agriculture. Long-range plans concerning insecticide applications by the Department of Agriculture's Division of Plant Industry are made available to the Commission, who then make surveys to indicate any potential dangers to fish or wildlife resources. Recommendations of precautionary measures to minimize damages are then made to the agricultural organization.

Regardless of what precautions are taken, the indirect effects of pesticides on the biotic community may be much more important than the outward, more obvious changes. Soil sterilization or contamination, systemic plant poisoning, or the accumulation of toxic compounds in the bodies of living animals are less easily recognized but probably much more significant than outright mortality.

In a statement made by the Assistant Secretary of Health, Education, and Welfare in March, he stated, "the disturbing aspect of the finding on the Lower Mississippi is that these fish kills are much more widespread, their long and recurring nature suggest a continuing contamination of the environment."

MR. STEIN: Mr. Stubbs, again there is more than one Assistant Secretary. Do you care to identify him for the record? I believe that was Assistant Secretary James M. Quigley?

MR. STUBBS: Yes, sir. It was.

MR. STEIN: Thank you.

MR. STUBBS: In view of the facts stated above, we of the Tennessee Game and Fish Commission recommend that, under terms of the Federal Insecticide, Fungicide, and Rodenticide Law, the manufacture, distribution, and use of Endrin, Aldrin, Dieldrin, and other related chlorinated hydrocarbon pesticides be banned until the full effects of these poisons can be determined and evaluated.

Thank you.

MR. STEIN: Thank you very much.

Are there any comments or questions?

(No response.)

MR. STEIN: Thank you very much, Mr. Stubbs.

Mr. Jones?

MR. JONES: We have been very fortunate in Tennessee with the Game and Fish Commission. For years, of course, we have had very, very close cooperation in working together. We could not operate and pick up information as quickly in regard to fish kills and other things without the help of the Game Commission. We think we have helped them too.

With this radio system, they had a fish kill reported. We sat there for two weeks waiting for the fish to die, and the fool fish didn't die. Mike hasn't forgiven them for that, because one of his officers sat there and waited. They should have died, but they didn't.

Mr. Eugene Holeman of the Tennessee Department of Agriculture is here.

Gene, if you will come up now, please?

While he is coming up, I ran across a cartoon the other day which I think you would appreciate. It says, "Pesticides can't do anything this year. Our sewage has killed them all." (Laughter.)

STATEMENT OF EUGENE H. HOLEMAN, STATE
CHEMIST AND FOOD AND DRUG DIRECTOR OF
THE TENNESSEE DEPARTMENT OF AGRICULTURE,
NASHVILLE, TENNESSEE

MR. HOLEMAN: Mr. Chairman, members of the conference, and ladies and gentlemen:

Lest we are too eager to jump to something new, and if --

MR. JONES: Excuse me for one minute. For the record, would you identify yourself by your full title, and so forth?

MR. HOLEMAN: I am Eugene H. Holeman, State Chemist and Food and Drug Director of the Tennessee Department of Agriculture. I have been designated by the Commission to come to this conference and make a statement for them.

To get back to my preliminary remarks, I want to say that lest we are eager to jump on to something new and proclaim today that Endrin is by far the most toxic substance known to man, let's not forget the old devil botulin, of which a mere seven ounces or approximately 2,001 drops distributed over the world would kill the entire human population. I believe that that is probably a good deal more toxic than the evidence shows with Endrin.

I want to read and put into the record for Commissioner W. F. Moss, the Director of the Department of Agriculture the following statement:

The Tennessee Department of Agriculture, in addition to its services and responsibilities to agriculture, is responsible for the consumer protection programs and the economic interests of the State, as they are related to the administration of such regulatory laws as the Tennessee Food, Drug and Cosmetic Act, the Pesticide Laws and Insect and Plant Disease Laws, as well as other regulatory laws and programs which are not related to this conference.

In the Tennessee Department of Agriculture, the food and drug laws and pesticide registration laws are administered by Mr. Eugene H. Holeman, Director and State Chemist, and the pesticide application and insect and plant disease control laws are administered by Mr. Howard L. Bruer, Director and State Entomologist.

I might add parenthetically that the five Division heads in the Department of Agriculture, including myself and Mr. Bruer, worked with Commissioner Moss in drawing up this statement.

In order to protect the consumer and to preserve desirable fish and wildlife it is necessary to have an orderly, continuous, scientific inspection, sampling and analysis program. This must include the regulation of disposal practices by manufacturers of pesticides, long-range toxicity studies and strict enforcement of registration and application laws. The Tennessee Department of Agriculture has not found nor has substantial evidence been presented to us showing water pollution by pesticides from either misuse of these materials in agricultural application or negligent disposal practices of manufacturing plants to warrant cancellation of registration for Endrin or related compounds. If, however, orderly scientific investigations reveal that the waters of our State and area are contaminated by misuse or careless manufacturing practice (1) with Endrin at toxic levels, (2) with other pesticides or toxic compounds at toxic levels and coming under our jurisdiction, we recommend the following course of action:

1. Notify each manufacturing plant to cease and desist from any practices which will contaminate the rivers and streams and follow this notice with a plant inspection;

2. Release, through agricultural news sources, including county agents and soil conservation agents, explicit instructions for the use of toxic chemicals;

3. Enact amendments to State and Federal

Pesticide Registration Laws whereby pesticide manufacturers must submit with requests for registration

(a) Results of toxicity studies made on marine life and desirable wildlife native to the waters and areas where the pesticide will be applied;

4. Require toxic chemical manufacturers to furnish State and Federal regulatory agencies a detailed outline of detoxifying and disposal facilities and practices followed in the plant where pesticides are manufactured;

5. Amend the State and Federal regulatory laws making it mandatory for control officials to review toxicity hazard data and waste disposal outlines, including plant inspection, before registrations are renewed or issued.

This statement is signed by Commissioner Moss, and I will file this for the record.

In addition to this, Mr. Chairman, I have and I brought with me a few brief recommendations which I would like to make. These are as follows: I recommend and I have recommended these proposals consistently during the past several years to our Senators in Congress and also to the Secretary of Health, Education, and Welfare, Senator Ribicoff, when he was Secretary, and Secretary Celebrezze at the present time.

These recommendations are:

1. To amend the pesticide laws in the Food and Drug Administration whereby zero tolerance will be clearly defined and the tolerance will be based upon scientific methods which are current and which will show the practical application of zero as relates to public health and to the scientific methods used.

As we know it, growing out of this conference and from previous conferences, zero tolerance is not a scientific expression that is now written into the pesticide laws.

2. I recommend and have consistently recommended that there is a need in the Department of Health, Edcuation, and Welfare of a national research institute. One of the primary functions of the institute would be to study the long-range cumulative effects of pesticide residues. It happens that private research facilities and industry research organizations cannot and often do not carry on the long-range studies on the cumulative effects of pesticide residue. This is purely a function of government. It is a function which would be of untold value in the enforcement of our protection laws, both in Washington and in the States.

3. I would like to recommend to this conference that there is a need for a national advisory council to

advise the Secretary of Health, Education, and Welfare on residue problems or other consumer protection problems which come up from day to day, just as this problem that has been presented to us.

4. Last of my recommendations, I would like to state that it becomes increasingly evident every day that the role of State governments becomes increasingly important in our public welfare. It is not possible for the Government in Washington to be all things to everybody, and especially in the area of protecting the wildlife, in preventing stream pollution, and in protecting the health and welfare of the consumer.

The Federal Government will have to recognize this fact, and it is urged that they closely coordinate their consumer protection program with the State officials in order that we will have much better and more strict and a more harmonious consumer protection program.

This can easily be done in the Department of Health, Education, and Welfare, as the precedent has been set, and it is done in the United States Department of Agriculture over many, many years, through the use of administrators or other officials charged with the responsibility of working with and cooperating with the State governments.

E. H. Holeman

Now, Mr. Chairman, in my role as State Chemist for Tennessee, I am responsible for the operation of the State laboratories in which we enforce food and drug laws, and the feed, fertilizer, limestone and other agricultural laws. Into this department would come and do come requests for chemical analyses or requests for surveys whenever Tennessee, or particularly county agents or soil conservation agents or others engaged in farm practices, have cause to think that some poison has been spread upon their land, and when some adverse reaction has taken place.

I have compiled here and I will furnish it to the reporter here for the record the results of these miscellaneous analyses since 1960.

Up to the present time, up until May 4th, we had a total of twenty-five requests of a nature serious enough for us to investigate. We had four pesticide residues or toxic substances in the soil.

Of these twenty-five tested over a four-and-a-half-year-period, twenty were tested for Dieldrin, one tested for chlorinated hydrocarbons in general, three tested for arsenic, and one tested for 1080.

Of these twenty-five samples, two revealed a positive test for Dieldrin, and others were negative.

We do not believe and we know from our program of control of the other insects in the Tennessee Department of Agriculture, that we are creating a condition or allowing to be created a condition in Tennessee from either runoff from farmland, forest land, or from misuse, of any serious situation.

We do admit and we have on the record that there have been some accidental kills from the application of pesticides. However, these instances have been rare.

Thank you.

(Mr. Holeman submitted the following documents:

Summary of Miscellaneous Samples for the Detection of Pesticides that were connected with any kind of Wildlife Kill for the Years of 1960-1961-1962-1963-1964 (to present)

May 4, 1964

1960	M.E.P. 464 - 1 sample of Cotton Seed Meal for pesticide suspected of killing earthworms at worm ranch. None found (Chlorinated Hydrocarbons)
1961	No miscellaneous samples analyzed with connections to wildlife kill in 1961.
1962	No miscellaneous samples connected with wildlife kill in 1962.

1963 M.E.P. 160, 161 and 162, pond water from Rt. 1, Trenton, Kentucky. Mr. Peter Askew -- for rotenone and arsenic. None found. Reported several fish killed in two separate ponds.

The following samples of pond water and soil were analyzed for Dieldrin in connection with fish kill on Augustine's farms.

M.E.P. 128, 129 -- pond water -- negative for Dieldrin.

M.E.P. 130, 132 -- pond water and mud -- trace of Dieldrin.

M.E.P. 131, 133, 152, 235, 236 -- pond water -- negative for Dieldrin.

M.E.P. 137, 138, 139, 140, 148, 149, 150, 151, 237, 238, 239 -- soil samples from ponds after they were cleaned out -- All negative for Dieldrin.

1964 M.E.P. 8 - Horse feed for 1080. One horse died. No 1080 found in feed but bait cups found around feed were positive for 1080.

25 samples tested over 4-1/2 years, of which 20 were tested for Dieldrin. 1 tested for chlorinated hydrocarbons in general. 3 tested for rotenone and arsenic. 1 tested for 1080. Of these 25 samples 2 revealed a positive test for Dieldrin. The others negative.

NOTE: These are miscellaneous samples sent in by farmers or agricultural agents where they suspected some poison.

Submitted by E. H. Holeman, State Chemist, Tennessee.

* * *

PLANS FOR IMPROVING CONSUMER PROTECTION

A. Establish a National Scientific Research Institute in the Department of Health, Education, and Welfare.

(1) This Institute will take over existing research programs and greatly expand continuous projects on the safety and effectiveness of chemicals classified as "additives," drugs and other substances, or pesticides, which become a component of the diet or are used for treating diseases, or used as cosmetics.

(2) The conclusions reached by the Institute staff, from controlled projects, with due consideration for results secured from industry and private research sources will form the basis for regulatory action and decisions by food and drug and public health agencies. (State and municipal regulatory agencies are now looking for such a source of information and they will use reports from the Institute as their basis for regulatory action.)

(3) The responsibility for scientific matters will be in a unit devoting all of its talents to scientific problems in the field of consumer health and protection.

(4) Regulatory enforcement agencies will devote their time and talents to the vast job of regulatory enforcement.

(5) Continuous experiments, which are not always done by present chemical manufacturers or private research agencies can be conducted on the cumulative effects of additives, chemicals, drugs and cosmetics. This includes pesticides.

B. Broaden the base for consumer protection by providing the leadership and funds for more active and more effective control by State and municipal governments.

(1) Appoint area administrators under the Food and Drug Administration. They will coordinate F.D.A. District work with planned projects in the several States in the F.D.A. District.

(2) Scientific and inspector personnel from the States can be trained in the district offices and sent back to State or municipal governments for more effective work.

(3) Provide matching funds for the States for

personnel for special scientific and inspection programs.

(4) Authorize grants-in-aid for research by State governments.

C. Make the Food and Drug Administration responsible for all advertising claims on foods, drugs and cosmetics and related products. With scientific research being conducted by the Institute the F.D.A. can and should enforce these measures.

C. Appoint a permanent Committee of Review (National Advisory Council). The committee to be drawn from government, industry and private sources to advise on matters of national importance in the consumer protection field.

Fresh ideas can be brought to the government by the committee and recommendations made for progress in the entire area. Such a committee will bring in university and private research people with industry and government forces to give added prestige to the research, public health and regulatory efforts of the Department of Health, Education, and Welfare.

This is a copy of the recommendations made to the Secretary of H. E. W., July 1960.

Eugene H. Holeman, Director and State Chemist, Tennessee Department of Agriculture, Nashville, Tennessee.)

* * *

E. H. Holeman

May 6 - 64

USPH-HEW Conference

To Chief File Clerk

Statement by Eugene H. Holeman

Food and Drug Director and State Chemist

Tennessee Department of Agriculture

Nashville, Tennessee

I recommend the establishment of a

(1) National Research Institute in HEW whose function (among other things) will be to study the accumulative effects of pesticide residues on human health. Private industry and independent research establishments are not always able to do this, and furthermore that is a function of government in their enforcement program for protecting the consumer. Results and conclusions from the Institute will be of tremendous value to State regulatory agencies.

These recommendations have been transmitted to former Secretary Ribicoff and present Secretary Celebrezze through Senators Gore and Walters of Tennessee.

(2) Zero tolerance, as now defined in the Pesticide Act, is not a scientific expression of the quantity of pesticide residues when sensitive instruments are used. This expression of the absence of a definite quantity should be defined in terms of a definite analytical procedure.

(3) The appointment of a National Advisory Counsel, this body to be drawn from outstanding scientists and officials from industry, State officials and research workers in universities and private research organizations. Recommendations of this body would be invaluable to the Secretary of Health, Education, and Welfare and the State officials in keeping abreast of needs in developing an orderly food science and consumer protection program.

(4) It is evident from the fish kill conferences and hearings that there is a most urgent need for closer Federal-State cooperation. The Government in Washington cannot be everything to everybody, and neither can the Federal Government provide the consumers with the protection they are entitled to. The State Stream Pollution Boards, State Game and Wildlife Commissions, and Food and Drug officials, must be strengthened and expanded by the State governments, and they must be given full help and cooperation by the Federal Government. This help would be in the form of grants-in-aid for specific scientific work and projects, and by the Department of Health, Education, and Welfare, appointing administrators to work directly with the State governments in these consumer protection programs.)

MR. STEIN: Thank you. Are there any comments or questions? Mr. Wood?

MR. WOOD: In addition to the presentation from the State of Tennessee, I have two questions I would like to direct.

Mr. Holeman, yesterday there was some question involved as to the meaning of zero tolerance for Endrin, or Endrin residues. I have since been informed that at the time this zero tolerance was placed, the analytical determination of it was 100 parts per billion.

Do you care to comment on that?

MR. HOLEMAN: I do not know of that instance there, but I do know that the tolerance which was set was based on good analytical practices at the time, and that is, I think, the tolerance that has been followed.

MR. WOOD: Well, the point I was interested in was that a zero tolerance is not necessary and certainly does not mean a zero concept. It is merely based on analytical language. I did want to verify that.

MR. HOLEMAN: Yes.

MR. WOOD: I have a question I would like to direct to Mr. Stubbs.

MR. STEIN: Yes, sir. Why don't you complete your questioning of Mr. Holeman first?

Mr. Stubbs, will you join Mr. Holeman?

MR. WOOD: Mr. Stubbs, you referred to experiences involving the use of Dieldrin. Certainly, there are large quantities of other control chemicals that you use, such as herbicides, pesticides and insecticides, particularly in the area of the Tennessee Valley Authority.

Would you care to make any comments on any of your experiences involving these?

MR. STUBBS: The only thing I can say right now is that the one that we have been involved in more often than any other and have felt fairly certain of has been just with the use of Dieldrin.

There have been miscellaneous fish kills that we have known about from the use of cotton poisons, tobacco poisons, and things like that.

MR. WOOD: Have you had any on mosquito control applications?

MR. STUBBS: It is very possible, but I wouldn't say for sure. No, sir.

MR. WOOD: Thank you.

MR. STEIN: Are there any other questions or comments?

MR. HOLEMAN: On clarification of that, Mr. Wood, it might be that we used Dieldrin in our control program. We have treated about 100,000 acres in Tennessee, which is a whole lot compared to a potato patch, but it is really a small amount compared to the land area of the State of Tennessee.

Mr. Chairman, excuse me for a minute. I might mention, along with what Mr. Wood said, that one of the reasons why we are probably more familiar with accidental spillage or things like that with the use of Dieldrin is because the Tennessee Department of Agriculture, through our cooperative agreement, and Mr. Bruer, who is Director and State Entomologist, informs us and sends us a list and map of all the areas in the State of Tennessee that they propose or plan to work in or spray during a fiscal year.

We are familiar with these areas. We notify the biologists; we notify the game and fish officers; and you might say we try to keep up with the situation as it is.

MR. WOOD: Is this for all applications of all pesticides, or just Dieldrin?

MR. STUBBS: No, sir. So far it has just been for the use of Dieldrin.

MR. WOOD: Thank you.

MR. STEIN: Mr. Holeman, as I recall, one of your recommendations is that the Federal pesticide laws be amended, and specifically the Food and Drug Law, whereby zero tolerances may be clearly defined.

MR. HOLEMAN: That's right.

MR. STEIN: This would seem to me to be establishing a Federal standard for this. Aren't you worried about a Federal standard usurping States' rights?

MR. HOLEMAN: Well, I believe in the Food and Drug Laws there is a provision for doing this very thing on food additives, but it was not carried through on the pesticides.

The pesticide amendment carried it first, but it did not occur in the Pesticide Law.

MR. STEIN: Then you are not worried in the Federal law that the Federal Government would set a tolerance?

MR. HOLEMAN: Oh, no.

MR. STEIN: Even though this might affect water pollution control and you would have a standard coming from Washington?

MR. HOLEMAN: That wouldn't bother us. We have the same law in Tennessee, and so do 36 other States, as the Federal Food and Drug Act.

MR. STEIN: It is very interesting to get the views of Tennessee on that.

I have one other question. Were you here yesterday when Dr. Grzenda was speaking about the Memphis situation, particularly in the vicinity of the Velsicol plant and the Hollywood dump?

MR. HOLEMAN: Yes.

MR. STEIN: I think, if I am not mistaken, you indicated that no information has come to your attention about the processes or the formulating of a pesticide which would have warranted action. I gather that from the statement you read from your Commission.

Were you aware of the material Dr. Grzenda presented before today?

MR. HOLEMAN: No -- well, I was not aware of any details of it. Of course, I was aware from the newspapers, as so many of you were yesterday, of reports on it, but I received no official notification of it.

MR. STEIN: Again, as I understand this, the condition that Dr. Grzenda found seemed to be of relatively long duration. It wasn't an overnight situation in the State of Tennessee.

MR. HOLEMAN: That is why we are wondering why we did not get the notification much longer ago than we did.

MR. STEIN: Well, thank you.

You know, we in the Federal Government wanted the same thing. You talk about State notification. This has been going on in Memphis for five years, or perhaps less. It seems that this might work both ways, that the State authorities have the primary jurisdiction, and the information should have possibly been funneled from the State to the Federal Government.

As I understand it, the way the Federal Government was called in was at the other end of the line, where Louisiana had asked for assistance.

MR. JONES: I will have to study that, Murray. I don't know what that means. In regard to this States' rights business, we are interested in anything that involves States' rights. We want to get that on the record clearly.

There are a few standards on something that moves as fast across State lines as food does. We might take that in any uniform standard nationwide with proper documented evidence.

When you get into a stream that moves so slowly, we will fight States' rights to the end on it.

We can argue that later.

MR. STEIN: We can argue that later.

MR. JONES: All right.

MR. STEIN: Just for the record, I know how fast some of these food and drug pesticides may move across a State line, but the Mississippi River, moving between 100,000 and 500,000 cubic feet a second, seems to me to move pretty fast across a State line.

MR. JONES: That moves about half a mile an hour, Murray.

MR. STEIN: If some of these manufacturers could sell their goods across the State lines at half a mile an hour, they would double their dividends.

MR. JONES: On this Hollywood dump that was mentioned yesterday, I did a little checking last night. We have a practice in Tennessee with regard to sanitary land fills. They mentioned the barrels that were there one day and gone the next day. Maybe somebody coming around got them hidden, but that is standard practice as recommended by the Public Health Service, I think, on all sanitary land fills, that you cover the thing once a day.

I can go to any land fill in the State and find garbage piled three, four, five or six feet high, and it had better be covered by the next day. If it is not, they are disregarding the recommendation. So, I don't think they hid the barrels just because the Public Health Service was hunting around. They didn't clean up just for that.

The next speaker we would like to call on is Mr. Bernard Lorant. He is Vice President of Research of the Velsicol Chemical Corporation.

Mr. Lorant.

STATEMENT OF BERNARD LORANT, VICE PRESIDENT, RESEARCH, VELSICOL CHEMICAL CORPORATION, CHICAGO, ILLINOIS

MR. LORANT: My name is Bernard Lorant, Vice President, Research, Velsicol Chemical Corporation, Chicago, Illinois.

Mr. Stein, members of the conference:

Being unfamiliar with these proceedings, I prepared my statement in the form of a letter.

To the Honorable Secretary, Health, Education, and Welfare, care of Mr. Murray Stein -- I trust it will be delivered.

MR. STEIN: It sure will.

MR. LORANT: Sir:

U. S. Public Health Service issued a release on March 19, 1964, relating to fish kills "involving millions of fish" taking place in Louisiana "each fall and winter since 1960." The cause of these fish kills has been attributed by U. S. Public Health Service to Endrin.

The April 6, 1964, report and a more recent preliminary report of the Public Health Service imply that the Endrin asserted to be causing the problem in Louisiana is originating from Endrin pollution in the Mississippi River at Memphis by virtue of Velsicol's effluent.

With this letter we submit four statements presented by Velsicol at Public Hearings held by the United States Department of Agriculture in recent weeks in Washington, D. C., Memphis and Baton Rouge, together with the statement of William A. Tompkins, Chief Aquatic Biologist, Massachusetts Division of Fisheries and Game, and Project Director, Massachusetts Pesticide Studies, which he presented at the Baton Rouge hearing. We also direct the Secretary's attention to the entire record of those three weeks of hearings. It is available at the office of the hearing examiner of U.S.D.A. in Washington, D. C.

MR. STEIN: Mr. Lorant, we don't have the statements here. Do you want the statements made a part of the record?

MR. LORANT: The four statements that I referred to will be made part of the record. I have them here.

MR. STEIN: Let's see how big they are.

MR. LORANT: I am not going to read them.

MR. STEIN: But I would like to see them. Do you want them printed in the transcript right after your statement, or do you just want them as appendices?

MR. LORANT: I would like them printed in the transcript.

MR. STEIN: We will be very happy to do it.

MR. LORANT: The conclusions reached by the Public Health Service are unsound. The evidence, including the recent analyses of Public Health Service, shows that the facts are:

1. At no time during the decade of operation of Velsicol's Endrin plant has Endrin caused a pollution problem in the Mississippi River at or below Memphis.
2. Endrin from Velsicol's plant at Memphis did not and could not have reached Louisiana via the Mississippi River.
3. Endrin is not the causative factor in the Louisiana-Mississippi River fish kills.

Known Facts Refute the Instrumental Analyses

A.

The analyses of the Public Health Service were made by microcoulometric gas chromatography. The numbers reported as being definite amounts of insecticide are in fact mere estimates based on the size and position of a blip produced by the needle of an electronic recorder. The analyst never sees the insecticide for which he is analyzing. Admittedly blips can be caused by unknown materials which the analyst calls artifacts; and artifacts are known to be contained in charcoal and reagent solvents used in analyses. Thus, the analyst cannot say from his chromatographic analysis that any insecticide whatsoever is actually present even when he obtains so-called positive results and reports a quantitative amount of insecticide supposedly present.

Illustrative of this is the fact that although Velsicol has never manufactured Dieldrin in Memphis or anywhere there is no hesitance on the part of the Public Health Water Pollution analysts to declare that they found it in massive quantities about Velsicol's Memphis plant. Since Dieldrin is a stereoisomer of Endrin one might conjecture that a minute amount of it could be formed along with the production of Endrin. If Dieldrin occurs at all in Endrin manufacture, it does so in amounts so minute that we have so far been unable to isolate it from the product made in our Endrin plant.

In sludge, Public Health supposedly found 35 times more Dieldrin, a product we have never made, than Endrin, one we do make. And the sample that had such a massive quantity of Dieldrin in it had not a single part per billion Endrin in it.

B. Lorant

Two unknown products characterized as X and Y by Public Health and alleged to be involved in Endrin production are asserted to travel with Endrin 500 miles down the river in unvarying proportion. It is certainly strange that, if it exists at all, Dieldrin completely separates itself from Endrin down to the last part per billion -- right next to Velsicol's plant.

Our analysts have noticed a peak where Dieldrin would be in various of our mud chromatographic analyses. But they have also shown by infrared spectroscopy that most of the peak cannot be caused by Dieldrin. Therefore the size of the peak cannot be relied upon as proof of amount or even the presence of insecticide.

Further, while it may be argued that one might theoretically expect a minute amount of Dieldrin from Endrin production, Dieldrin would certainly not arise from Heptachlor production. Nevertheless, Public Health reports 120,000 parts per billion Dieldrin in a sample taken from our Heptachlor plant. Not even a single part per billion of Endrin, the product we really make. To say the least, these facts cast serious doubt on the analytical quantities reported by Public Health.

B.

The fact that there have been no fish deaths reported in the Mississippi River at or near Memphis, the area of supposed highest concentration of Endrin contamination, during the entire decade of Endrin manufacture, speaks eloquently of the lack of significant river contamination with Endrin; or else Endrin does not affect fish. An asserted contrary indication by an electronic recorder employed experimentally in Atlanta cannot control.

C.

Public Health's report shows Endrin could not have been carried the 500 miles from Memphis to Baton Rouge via the Mississippi River. Endrin is not soluble in water and is absorbed in solids. Consider the numbers shown in the pesticide analyses of mud samples by microcoulometric gas chromatography recently released by Public Health. In a chemical drainage creek which has received Velsicol's and other plants' effluents for many years, the analyst reports as much as 116,000 parts per billion (116 parts per million) Endrin. But both the mud and water in the Mississippi River just below Memphis are reported to contain zero parts per billion. If the more than 100,000 parts per billion found in the mud from Cypress Creek near Velsicol's plant is completely dissipated in a few miles flow down to the Mississippi, it follows that there is no Endrin to be carried further, let alone 500 miles downstream from Memphis.

To summarize, there is no significant Endrin in the Mississippi River at and below Memphis. This is proved by the Public Health report. More importantly, it is proved by the fish. There is no fish kill at Memphis.

Furthermore, our laboratory analyzed catfish recently caught in the Mississippi River both above and below Memphis. Using the gas chromatographic technique employed by the Public Health Service in its tests, these fish contained no Endrin. Similarly, by our tests the mud at the juncture of the Wolf River and the Mississippi River contained no Endrin.

Except for the analyst's number which is asserted to link Endrin to the Louisiana fish kill, all the known facts and circumstances point to a causative factor other than Endrin. These are discussed in the statements submitted with this letter and also in the record available as a result of the hearings recently concluded by the U.S.D.A. Some of these are:

1. The theory of the Public Health Service that Endrin is contained in the mud around Baton Rouge and that the bottom feeders are primarily

affected is refuted by the fact that of the 5,175,000 fish estimated to have been killed in 1963, 5,000,000, or 96.6% of the total, are salt water Menhaden which are not bottom feeders.

2. The contemporaneous Federal and State reports refute the assertion of annual fish kill. For the four-year period in question the Louisiana State report discloses no such fish kill in 1961 and the Federal reports disclose no such fish kill as to 1961 and 1962.

3. The fish kills in 1961 and 1962 are asserted to be nominal as compared to 1960 and 1963. This patter of intermittent fish deaths is inconsistent with the conclusion that the cause is a persistent, increasing contaminant having a pattern of annual recurrence.

4. William A. Tompkins, Chief Aquatic Biologist, Massachusetts Division of Fish and Game, reported after experimentation: "The reported observances of the fish kill occurring in the Mississippi River do not parallel the symptomatology of endrin or related pesticides."

5. The reported fish kills in Louisiana occurred not in the summer when the river water is warm

but in the late fall and winter when the river water is cold. Endrin is much less toxic in cold water than in warm water.

6. Endrin comprises only about 2% of all the chlorinated hydrocarbon agricultural pesticides used in the lower Mississippi cotton and sugar cane area in question. It is used in the summer. Endrin thus cannot be a major pollutant.

7. Endrin in the Mississippi River is reported by Public Health analysts in parts per trillion. When an analyst is forced to employ parts per trillion as a means of detecting the presence of a pesticide he is in an area of considerable conjecture. One part per trillion is so infinitesimal as to defy comprehension let alone detection. For example, compare 1 part per trillion Endrin in water with one second in one trillion seconds. A trillion seconds is 32,258 years or 30,294 years before the birth of Christ. Most contaminants in the river cannot be seen at levels one hundred thousand times more than a part per trillion. These contaminants, though present and perhaps the cause of kill,

have not been considered.

8. There is no record of fish kills in the Mississippi River near Memphis in the last decade, except for one in Lake McKellar and that was due to low oxygen content.

9. It is hypothesized by the Public Health Service that the fish die in the winter because they accumulate Endrin in their fat over a long period of time and then mobilize it by utilizing their fat when river food is scarce. This is contradicted by the report of the Louisiana Wild Life and Fisheries Commission, which says that bottom food was plentiful at the time of the 1960-1961 fish kill.

10. Whatever is causing the fish kill it has not affected fauna normally very sensitive to Endrin.

11. Although sufficiently sensitive testing methods were employed, neither the U. S. Public Health Service nor the Louisiana State scientists were able to detect the presence of Endrin or other agricultural insecticides in the 1960-61 fish kill investigation. The symptoms in 1963-64 were the same as those observed in 1960-61. The 1960-61 fish kill was reported to be caused

by dropsy after isolating the causative organism.

12. According to the Public Health Service, the fish received by Dr. Sniezko and examined by him and his staff were one catfish and two shad. No Menhaden were examined despite the fact that Menhaden comprised 96.6% of the fish estimated to have been killed in 1963-64.

96.6 percent, in the vernacular of Public Health, is 966 million parts per billion.

Velsicol urges that the problem be very carefully defined and that conclusions be drawn from all of the pertinent circumstances. We are willing to cooperate in any investigation, in Louisiana where the problem exists, in Tennessee where our plant is, or elsewhere.

B. Lorant

In addition to that statement, I likewise wish to read, although I am submitting it for the record, because it is brief, the portion of the transcript from the United States Department of Agriculture hearings, at which Mr. Tompkins made his statement.

This is the statement of William A. Tompkins, Chief Aquatic Biologist, Massachusetts Division of Fisheries and Game; Project Director, Massachusetts Pesticide Studies. Mr. Tompkins is doing the talking:

> "MR. TOMPKINS: I am William A. Tompkins. I reside at 14 Fernbrook Road, Northboro, Massachusetts. I am Chief Aquatic Biologist of the Massachusetts Division of Fisheries and Game. I am Project Director of the Massachusetts Pesticide Studies.
>
> "Last week our lab was requested by the Velsicol Chemical Corporation to investigate the toxicity of endrin to fish and to characterize symptomatology. On April 19, 1964, 100 brown bullhead, Ictalurus nebulosus, were subjected to concentrations of endrin ranging from .3 ppb to .3 ppm. The dispersion vehicle used was acetone at .3 cc per liter of water. The fish were random sized adults ranging from six to ten

inches.

"As of 80 hours, the last possible observation before leaving for this meeting, no fish in the 0.3 ppb or 3 ppb had died. They appear perfectly normal. In the higher concentrations, .3 and .03 ppm, the initial reaction was that characteristic of any compound causing distress, for instance, violent evasive action and loss of equilibrium. All fish were at the bottom of the 30 liter aquaria at the time of death (1-6 hours) and no fish were observed floating at the surface. Prior to and immediately after definitive death manual palpitation failed to indicate the presence of gasses in the alimentary tract. Subsequent autopsies showed no distension of this or the air bladder beyond that observed in thousands of individual fish autopsied by this laboratory. Sub-deman petechia and dermal blanching, a characteristic of trauma in this and related species, were observed in six percent of the test fishes and confined to that group treated at .03 ppm. No evidence of gross external or internal hemorrhaging was present.

"This laboratory has found that the reported "observations of the fish kill occurring in the Mississippi River do not parallel the symptomatology of endrin or related pesticides. Thank you."

MR. STEIN: Thank you. Does that conclude your statement.

MR. LORANT: No, sir. I have one more matter I would like to inject into the record, and that is a portion from the Tenth Biennial Report covering the calendar years 1962-1963, Louisiana Wildlife and Fisheries Commission. This covers the two last years occurring in the tables estimating the fish deaths which are shown in the Public Health Report that is dated April 6th, and that dated May 5th. It likewise refers to the current kill.

I read from Page 211. I am going to read the entire section on the fish kills because it is very short. It says:

"The Division of Water Pollution Control has again, during the past two years, investigated numerous fish kills attributable to both natural and man-made factors. Most of the natural kills and several of those attributable to man's activities were caused by depletion of dissolved oxygen. In the natural kills, most of the oxygen "depletions have been brought about by plankton bloom or accumulation of plankton along with low water levels and high water temperatures. Most of the man-made oxygen depletions were caused by discharges of waste from food processing plants, particularly sweet potato canners, during the late summer and early fall.

"Foremost among man's activities contributing to fish mortality is the widespread use of insecticides, particularly the application for the corn borer control. Fortunately the kills from insecticides have been less numerous during the insecticide application season.

"Louisiana continues to be plagued by sporadic kills during the cool water months. These kills show a rather consistent pattern that closely resembles that of the massive kills noted in the Atchafalaya system and the Mississippi River during the winter of 1960-1961. None of the subsequent kills have reached such massive proportions.

"However, there are two additional causes for concern that have been noted in other streams in the Florida parishes, as far east as the Pearl River:

B. Lorant

"1. The kills this year have been noted earlier in the year, mid-October versus mid-November, and at a higher water temperature, 20 to 22 degrees versus below 15 degrees Centigrade.

"In addition to the running of analyses in the Division laboratories, numerous samples of water, bottom mud, food organisms and fish have been sent to the following organizations: Robert A. Taft Sanitary Engineering Center, U.S. Public Health Service, Cincinnati, Ohio; Microbiological Laboratory, U.S. Fish and Wildlife Service, Kearneysville, West Virginia; Patuxent Research Center, U. S. Fish and Wildlife Service, Laurel, Maryland; and Fish Farming Experimental Station, Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service, Stuttgart, Arkansas.

"These materials, when analyzed in the various laboratories, have shown presence of insecticides at very low or even insignificant levels in a small percentage of the fish examined.

"In addition, bacteriological examination "has disclosed presence of bacteria belonging to known pathological groups in some but not all of the fish.

"It is hoped that in the continued studies, some definite evidence of the cause of these mortalities will be found. Additional minor kills have been noted that were due to thermal shock, toxic algae bloom, industrial discharge of toxic materials, and some easily discernible fish diseases. However, none of these have reached the alarming proportions of some of the kills attributed to insecticides or the widespread mortality of unknown origin."

Thank you.

(The prepared statements referred to by Mr. Lorant are as follows:

Statement of Velsicol Chemical Corporation
Relating to Recent Reports of Fish Kills
on The Mississippi River Submitted Pursuant
to Notice of Public Hearing, Federal Register,
April 2, 1964, Page 4723

B. Lorant

I. Introduction

This statement is directed to the issues raised by Notice of Public Hearing published April 2, 1964, as they relate to Endrin. It is submitted on behalf of Velsicol Chemical Corporation, manufacturer of Endrin.

The Notice, in pertinent part, says:

> "Recent reports of fish kills on the Mississppi River have raised the question as to whether the use of the economic poisons aldrin, dieldrin and endrin may be responsible for such losses and, if so, whether the present requirements under the Federal Insecticide, Fungicide and Rodenticide Act with respect to the registration of such products should be modified."

Velsicol's first information relating to fish deaths came from a meeting in Washington at the office of the Manufacturing Chemists Association with two Public Health Service officials. We were then informed that the Public Health Service was initiating an extensive project to seek to determine the cause of the "fish deaths." We offered our cooperation. This meeting occurred sixteen days prior to the press release by Public Health on March 19, which apparently led to the public hearing notice by U.S.D.A. on April 2.

Two other meetings with U. S. Public Health officials were held in Cincinnati, March 6 and April 1 respectively. No detailed data were made available to us although analytical results were generally discussed. The subject matter of these meetings on April 1 was expressly limited by Public Health. We were told that they were not to present results, programming, policy, interpretation or expectations. Discussion was to be limited to analytical procedures. Apparently Monsanto Chemical Company (whose pesticide products are not involved) was the only company favored with samples. Our request for samples was not granted. Some of the information in this presentation represents that obtained at these meetings. This sequence of events, occurring only in the past few weeks, is presented to show why we are unable to more specifically comment on certain aspects of the experimental activity carried on by Public Health and why our own experimental effort has been necessarily limited to date.

The "recent reports" referred to in the Federal Register stem from a press release of three weeks ago (Thursday, March 19, 1964) by the Public Health Service, U.S. Department of Health, Education, and Welfare. This release said studies were made by the Health Service because of a series of fish deaths "involving millions of fish" taking place in Louisiana "each fall and winter since 1960."

II. The Problem Has Not Been Accurately Stated

Data published annually by the U. S. Public Health Service contradicts its own release.

In 1961 and again in 1962 the U. S. Public Health Service reported no kills from any cause in Louisiana in the winter months of January, February, March and the fall months of October, November and December. While the data compiled for 1963 by the U. S. Health Service do not show fish kill in Louisiana by month the number of fish deaths reported there represents only about one percent of the reported fish deaths in the country.

The only fish deaths in Louisiana shown as having occurred in the fall or winter of any year were two such reports in December of 1960. While these reports stated that a problem existed for sixty days, no estimate of the number of fish deaths was made.

Clearly, the U. S. Public Health Service has no basis for saying that massive and continuing fish kills which involve millions of fish have taken place each fall and winter since 1960. Our recent inquiries in Louisiana provides no basis for such a statement. The objective data published annually by the U. S. Public Health Service during the period in question do not import a problem of the kind and character so vastly publicized in recent days. Furthermore, these data contradict the concept of a continuing buildup of pollution from persistent pesticides.

III. Endrin Is Not Killing The Fish

Certainly some fish are dying in the area in question. But Endrin is not the causative factor for the reason that Endrin does not cause the observed symptoms and, all the circumstances show there is no significant environmental contamination with Endrin.

1. Symptomatology

The symptoms described by the U. S. Public Health Service officials of channel catfish observed dying in the Mississippi River included internal and external hemorrhaging. Hemorrhaging is not a symptom of Endrin intoxication. (More detailed symptomatology is presented later in this text.) While this fact is well known for fish and mammals generally, we again experimentally verified it specifically for channel catfish by treating them in tanks with varying, but lethal, quantities of Endrin. No hemorrhaging resulted.

The U. S. Public Health officials further observed that when tissues (gut, liver, kidney, spleen, muscle), of fish, caught in the Mississippi River when they were believed to be dying, were fed to mice, the mice died with extensive hemorrhaging of intestine. Endrin intoxication does not cause such intestinal hemorrhaging in rodents. Furthermore, the acute feeding of Endrin to mice at the level claimed to be contained in the fish tissue (about one ppm) would cause no reaction - not hemorrhaging, not death, not sickness. (Toxicity of Endrin for Laboratory Animals, Treon, et. al., Ag. and Food Chem., 3, 842-848, (1955)). Whatever disease or other toxic factor caused these mice to die as described, it could not have been Endrin.

B. Lorant

2. The facts show there is no environmental contamination with Endrin

The concept of a toxic environmental contaminant is untenable when considered in the light of the pattern of fish deaths objectively reported. Uniform or increased use of Endrin would not cause kill one year (1960) and then none the next two (1961-1962). The use of Endrin neither ceased nor diminished after 1960; it increased. If Endrin were a chronic, persistent, increasing contaminant, the observed effect on fish would be commensurate. This is not true even after more than a decade of use.

A. Endrin is safer to fish in cold water.

The press release of the U. S. Public Health Service states that fish deaths occur in the fall and winter, when the weather and water are presumably coldest. The tolerance of fish to Endrin markedly improves as the water gets colder. There is progressively as much as a twenty-five fold decrease in toxicity of Endrin to fish as the temperature of the water decreases through a range of about 20°C.* (*Katz and Chadwick, U. S. Public Health Service and Department of Fish and Game Management, Oregon State University (Trans. Amer-Fisheries Soc. 90 [4] 394-397 [1960])). Endrin concededly causes no problem in the Mississippi River in summer. It is less a problem in winter.

B. Endrin is used in the summer. Endrin is used agriculturally May through August, the hot months. If such use were contaminating the lower Mississippi drainage basin it would affect fish shortly after application when they are most susceptible, and not in the coldest months when they are most resistant.

C. The quantity of Endrin applied is comparatively small. It cannot be the major contaminant. Endrin is used primarily for protection of cotton. It is highly effective in this function and only about 0.3 pounds per acre per treatment is required for good results. Comparatively, DDT and Toxaphene are applied to cotton at a rate respectively 5 and 10 times that of Endrin. In the drainage area in question there is at least fifteen times more DDT and about twenty times more toxaphene used than Endrin. Environmental contamination is by definition greater with these compounds than with Endrin.

U. S. Public Health scientists find DDT or its metabolite in every fish analyzed. It is universally present at what is termed "reasonable levels" of less than 0.1 ppm.

The universal contaminant, DDT, is found in fish in concentrations of less than ten percent that claimed to be found for Endrin. But fifteen times more DDT is applied annually and DDT has been used for more years than Endrin. Further, the propensity for fat storage of DDT is greater than that of Endrin. This is a curious anomaly that requires careful attention.

When an analyst mixes Endrin and DDT together he reasonably expects that application of a valid analytical technique would disclose the weight ratio of the two component mixture. If he threw 15 grams of DDT and one gram Endrin into a beaker, results showing the presence of 10 times more Endrin than DDT would be summarily rejected regardless of the elegance of the technique.

It is not suggested that throwing 15 parts DDT and one part Endrin into the agricultural area in question is identical to throwing chemicals into a beaker. But it is suggested that in such circumstance more DDT than Endrin should be found by valid techniques. This is necessarily true if the fact is that DDT is present in sufficient quantity to contaminate every animal, and Endrin is not. And that is the fact.

The truth is that the analyses by U. S. Public Health Service for DDT are correct. The "reasonable levels" of less than 0.1 ppm are most probably accurate and certainly represent no hazard. Neither now, nor in the future. But the reports of analyses for Endrin indicating concentrations many times that found for DDT conflicts with every pertinent fact.

Endrin is connected to the fish issue only because of some analyses hurriedly made in a crash project.

Our laboratory recently found 50 parts per million DDT, on a fat basis, in marine organisms. It would have been so reported except that further experimentation showed the preponderance of those 50 parts to be an artifact and not DDT. Working at high levels of 50 parts, errors are relatively discernible and subject to correction by experiment. And an error of 5, or even 10 ppm is not significant. On the other hand, when working at levels of a fraction of a part per million, billion or trillion, inherent analytical error is geometrically greater and less subject to recognition or correction. Quantitative validity at these levels, if possible at all, requires at least a massive effort and rigorous statistical appraisal. This would have been impossible in the time allowed to the U. S. Public Health Service.

D. Our recent analyses are in accord with all the pertinent facts.

Although we were not given samples by the

U. S. Public Health Service, we did secure samples through our own efforts and also from Louisiana State officials. These were analyzed by us with the following results.

Flesh and blood of channel catfish caught last week in the Mississippi River at Memphis, Tennessee, were anlyzed for Endrin. No Endrin was found at a sensitivity of 0.1 ppm.

Flesh of channel catfish taken from the spillway at the junction of the Mississippi River and Atchafalaya Basin were analyzed for Endrin. Again no Endrin was found.

A sample of carp taken from the mouth of the Mississippi contained no Endrin.

Fish taken alive in January of this year from the area of fish death in Louisiana were also found to contain no Endrin.

Channel catfish in aquaria with water purposely treated with Endrin to observe symptomatology were analyzed after death. These fish contained from 1.5 to 3.5 parts per million Endrin in flesh depending on the amount of Endrin used in the treatment. DDT was noticed in 11 of 14 samples at the level of 0.1 to 0.2 ppm except for one sample which contained 0.6 ppm.

The absence of Endrin in the fish samples taken from the Mississippi River both at Memphis and in Louisiana, in the spring and in the winter clearly proves absence of Endrin in the fish environment.

The conclusion that Endrin is absent from the Mississippi River environment agrees with results of river water analyses by scientists of the Department of Health, Education, and Welfare published as recently as September, 1963 (Science, Vol. 141, No. 3584, p. 901). In analyzing for pesticides at 101 locations including the Mississippi, only DDT was found at those 14 locations where any insecticide was present. The only exception was one location (Savanah R.) where Dieldrin was found.

IV. The Invisible Factors

Chlorinated hydrocarbon pesticides, such as Endrin, can be "seen" by the skilled chemist at fantastically low and insignificant concentrations. In fact, these products are sometimes "seen" even in their absence.

The U. S. Public Health Service personnel recognize that toxaphene can be found only when it reaches levels of about 100 times the concentration at which Endrin is readily found. But only 20 times more toxaphene than Endrin is used. Toxaphene is toxic to fish. Since toxaphene is invisible to analytical techniques at these levels, it is neither seen nor reported as a potential contributor to this problem. No invisible factor ever is.

Invisible factors or stresses abound in the Mississippi. Near the Delta it is a natural body of fresh water that has assumed unnatural characteristics. Its proximity to the salt water of the Gulf, combined with mass pollution from urban sewage and industrial waste discharges, produce an environment of staggering ecological complexity.

To select any one pollutant from all the contributing factors that could result in mass mortality of fish is to ignore the problem. Even the epidemiology of a transmissible disease would be subject to the complex stresses imposed. Nowhere are these stresses more apparent than in the Mississippi estuary, where the respective constituents of fresh and sea water are brought into intimate, varying association with each other. It is surprising that in such a complex, fluid environment the mortality problems are not occurring continually. But it is not surprising that mortalities have occurred with regularity before Endrin use began.

The Yearbook of Agriculture (1955) says:

> "Intrusion of salt water from the Gulf into the marsh area through rivers, bayous, and drainage and transportation canals occurs periodically in many areas."

Further,

> "As the water evaporates, salt concentrations become greater, to the extent that soils and vegetation are damaged and various forms of aquatic wildlife habitats may be destroyed."

Land in such areas may actually become hazardous to livestock. The enormity of the problem is emphasized by the statement:

> "The problem becomes more critical as natural marsh communities are disturbed by dredging of ship channels and the construction of roads, canals, and industrial developments."

A. N. Turcan, Jr. (p. 631 ibid.) in discussing the Louisiana problem said:

> "Salt water encroachment has become serious

> in several places. One of the most important of these is near Milton, where saline water has encroached into the principal fresh water aquifer (called the Chicot reservoir) from the Vermillion River and thus endangers the water supply of a large part of southwestern Louisiana. Other places where notable encroachment has occurred are Baton Rouge, New Orleans, Norco, and in and near several of the larger salt domes, as at Port Barre and at Chase."

That natural occurrences can cause mass mortality is dramatically described in the following quote from "The Treatise On Marine Ecology and Paleoecology" edited by J. W. Hedgpeth (p. 946.)

> "Around the mouth of the Mississippi, crevasses and spillway openings have occasionally obliterated marine life over some hundreds of square miles."

On the Gulf Coast of the United States (according to this reference) four conditions bring about widespread mortality to marine life: a great influx of fresh water, cold waves, phytoplankton blooms (such as red tide) and oversalinity.

Other known lethal causes include vulcanism, seaquakes, lack of oxygen or presence of hydrogen sulfide.

Reoccurring mass mortalities prior to the usage of pesticides is common. The Treatise referred to above at page 949 said:

> "Mass mortalities occur every few years; ... fishes were killed in large numbers on an average in one of every six years at Sanibel Island, Florida from 1886 to 1934."

The weight of fish killed along the Texas coast in January 1951 was estimated at several million pounds and in 1947 at 16 million pounds.

The 1960-1961 report (p. 208) by the Louisiana Wildlife and Fisheries Commission cited the following example of interaction of two non-lethal natural causes resulting in fish kill.

> "Another interesting fish kill was one that occurred during the summer of 1960 in a small lake on the campus of Louisiana State University and on which the Division staff worked in close cooperation with Dr. Jess Muncy of the University staff. Analysis of conditions revealed a high oxygen content (always in excess of 8 pppm), a high pH (not less than 9.5 and at times higher than 11), and a heavy bloom of green algae

"(predominantly a species of the genus Gymnodinium). Bioassay showed that neither the high pH alone nor the presence of the species of Gymnodinium alone caused mortality, but the two together caused rapid mortality of the test fish. It is interesting to note that no species of Gymnodinium had previously been reported to be toxic."

V. Experience and Data Have Proved Chlorinated Hydrocarbon Insecticides Safe

It is repeatedly urged that chlorinated hydrocarbon insecticides such as Endrin, DDT, Dieldrin and Aldrin, are increasingly contaminating our total environment. It is suggested that these pesticides concentrate in the fat of animals and that this phenomenon is increasingly severe through the food chain to man.

This reasoning ignores the facts.

Chlorinated hydrocarbon insecticides have been subjected to more intensive study, by more scientists, for a longer period of time, than any other group of chemicals. We can analyze for them with the sensitivity not even approached by other chemicals. And these analyses show that these chemicals are not contaminating our food supply or our environment.

Mr. Henry Fischbach, Director of Division of Food, Bureau of Biological and Physical Sciences, Food and Drug Administration, Department of Health, Education, and Welfare, commented in the following fashion on this subject at a recent symposium sponsored by the National Academy of Sciences:

> "Total diet samples were analyzed for organophosphorus and chlorinated organic pesticides. Screening methods for organophosphorus insecticides are not yet as fully developed or as sensitive as those for the chlorinated organics. The present limiting sensitivity for the organic phosphate pesticides is ca 0.1 part per million whereas that for many of the chlorinated organics is a few parts per billion. Consequently, for this discussion on refined analytical methods I will refer only to the chlorinated organic pesticide data."

Mr. Fischbach was referring to the analysis of total diet samples representing crops and practices throughout the country. He then further said:

> "You will note that only a few of the pesticides appear in the table. Actually these total diet samples were screened for about 20 of the chlorinated organics and, for brevity, only those which were detected are listed in the table. (Endrin was not listed.)
>
> "You will also note that the residues of chlorinated organic insecticides in all samples generally were very low compared with established tolerance levels."

Studies conducted variously by U. S. Food and Drug Administration, U. S. Public Health Service, Chicago Board of Health and others, show that the level of DDT in human fat has not increased from 1951 to the present date. But the use of DDT has increased.

The following is quoted from a Chicago Board of Health paper recently submitted for publication:

> "The most significant feature of these analytical results is that they indicate that there has been no progression of storage of DDT in the general population since the first studies by Laug et al in 1951."

These studies on human fat further show that all the other chlorinated hydrocarbon insecticides combined represent a negligible value; a small fraction of the relatively constant DDT value found. Most of the chlorinated hydrocarbon insecticides are not even present in human fat in detectable amounts. Clearly there is not a significant or increasing exposure to chlorinated hydrocarbon insecticides as shown by over a decade of analytical results. There is no increasing contamination.

The fact is that with the uniquely superior techniques developed for chlorinated hydrocarbons we can monitor levels of background contamination by these chemicals as effectively as is done for background radiation. For several years Velsicol has carried on such a continuing study in cooperation with the Chicago Board of Health. Other companies and government agencies have done similar work.

Mr. Fischbach, on this subject, made the point that with ultrasensitive techniques, trends of pesticide accumulation can be followed and evaluated long before any actual hazard appears. These techniques have been developed for chlorinated hydrocarbons but not for other chemicals. Monitoring these chlorinated hydrocarbons is a major, continuing function of many agencies both public and private including Velsicol. The facts thus developed prove absence of hazard. Anomalously, the fact that we can and do continuously monitor chlorinated hydrocarbons causes these chemicals to remain continuously in the spotlight. They are not invisible chemicals. They are visible even when when they create no effect. We should not substitute for these visible compounds others which are invisible and unknown.

Chlorinated hydrocarbons may not be carelessly used with impunity. But proper usage has been proved to be without hazard after more than twenty years history of extensive practical experience and more extensive study. In the light of these facts, no one may urge replacement of these chemicals for others whose potential hazards are not known and for which techniques are unavailable to determine them adequately.

VI. The Explanation of The Fall and Winter Fish Kill in Louisiana

The following is quoted (starting at page 206) from "The Ninth Biennial Report 1960-1961, Louisiana Wild Life and Fisheries Commission." (Published by the Commission in New Orleans.)

"Fish Kills

"The Division has investigated numerous

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"fish kills during the past two years. These have included both natural kills and kills attributable to activities of man. Waters in which these kills have occurred ranged from farm ponds (an accommodation to the public) to the two largest rivers in the state, the Mississippi and the Atchafalaya.

"Most of the natural kills have been the result of oxygen depletion caused by heavy blooms of plankton in the spring and early summer. The vast majority of these have occurred in farm ponds with a few having been in small sluggish streams or lakes.

"The most spectacular fish mortality ever noted in Louisiana, one which was to demand a great part of the time of several staff members for several months, and result in the loss of untold tons of fish, started with the report of a fish die-off in the Atchafalaya River near Krotz Springs on November 17, 1960. This was rapidly followed by reports of fish die-offs from widespread areas in the Mississippi River and the Atchafalaya River Basin. Ultimately, mortality "was noted in the Mississippi River from Lake Providence (mile 480 AHP) to Venice (mile 10 AHP) and in the Atchafalaya drainage from Old River to Morgan City. Fish were neither reported nor observed dying in the Atchafalaya drainage (Red and Black Rivers) above the Old River connection with the Mississippi River. However, mortality in speckled trout and other marine forms were noted in brackish bays near the mouth of the Mississippi.

"Species of fish affected in the Mississippi and Atchafalaya included catfish, carp, fresh water drum, and threadfin shad. Approximately 95% of the fish dying were catfish. In addition, most of the catfish found dead or dying, particularly in the back water areas of the Atchafalaya Basin were thought to be from the 1960 hatch. These fish were six to eight inches in length and weighed one-half to three-fourths of a pound. However, proportionate numbers of larger specimens were noted including a few large individuals weighing 25 pounds or more.

"Dissolved oxygen and pH determinations were made at all locations where dead or dying fish "were checked by Division personnel. In all cases the pH fell within a satisfactory range of from 6.8-8.2 and the dissolved oxygen content was in excess of 7 ppm and approaching saturation for the prevailing water temperatures.

"Repeated observations of dead or dying fish revealed several rather constant phenomena. Most of the catfish were noted to be hemorrhaging around the mouth and many were hemorrhaging about the fins, particularly the pectoral fins. In every instance the catfish were observed to have a distended abdominal area. Gross examination revealed that the distention was due to distention of the air bladder and digestive tract. The latter was devoid of food material and contained only gas. or air and a very small amount of frothy material. This in spite of the fact that analysis of the bottom fauna revealed an abundant food supply consisting of snails, clams, leeches, oligachaets, may fly niads, gammarids, fresh water shrimp, and chironomids. Dying fish were swimming at the surface (often inverted) in a very lethargic manner and were easily captured by hand. However, even though they were at the surface, the fish exhibited "no gulping action as are noted in case of respiratory difficulty. Another feature noted was belching of large quantities of air or gas by some of the catfish.

"Repeated attempts were made to bring affected fish into the laboratory with the intent to expose healthy fish from another area where no fish mortality had occurred. Of the numerous fish collected, only four individuals surved the trip to the laboratory and these recovered completely. Two healthy fish held in the tank with these four individuals showed no ill effects.

"Extraction of organics with carbon tetrachloride were made from bottom muds in the affected area and the extracts subjected to infrared and paper chromatography analyses. These techniques have offered no clues to possible causes of mortality.

"Mud samples and fresh water clams were sent to the Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, for analysis and identification of insecticides as a possible cause of the fish mortality. The results of this phase of the investigation were negative. Dead or "dying fish were frozen and shipped to Dr. S. F. Snieszko, Microbiological Laboratory, U. S. Fish and Wildlife Service, Kearneysville, West Virginia. In addition, fish, clams, and mud samples were submitted to the Patuxent Research Center, U. S. Fish and Wildlife Service, Laurel, Maryland. The materials shipped to Dr. Snieszko arrived in poor condition due to thawing and the results of examinations were inconclusive but indicated possible presence of abdominal dropsy.

"More detailed examination of specimens in the laboratory of the Division indicated considerable degeneration of the digestive tract, spleen, and other portions of the viscera. Bacterial cultures were made utilizing parts of the viscera and blood of affected fish and tests conducted on these cultures indicated the presence of Aeromonas liquefaciens, the causative organism for abdominal dropsy in fish.

"Mortality gradually decreased through January and eventually ceased in early February with the beginning of the late winter and early spring rise of the Mississippi River. There seems to be little doubt that the disease broke out "farther up the Mississippi and spread down the Mississippi and Atchafalaya. It is interesting to note that at the same time, fish dropsy was encountered in the tanks of minnow dealers receiving their stock from several breeders in Arkansas."

The fish found dying in the Mississippi River each fall and winter since 1960 exhibited the same symptoms each year.

* * *

B. Lorant

STATEMENT

Of

Velsicol Chemical Corporation

Relating to

Recent Reports of Fish Kills on the Mississippi River

Submitted Pursuant to

Notice of Public Hearing

Federal Register, April 2, 1964, Page 4723

Baton Rouge, Louisiana
Thursday, April 23, 1964

I. Introduction

This statement is directed to the issues raised by Notice of Public Hearing published April 2, 1964, as they relate to Endrin. It is submitted on behalf of Velsicol Chemical Corporation, manufacturer of Endrin.

The Notice, in pertinent part, says:

> "Recent reports of fish kills on the Mississippi River have raised the question as to whether the use of the economic poisons aldrin, dieldrin and endrin may be responsible for such losses and, if so, whether the present requirements under the Federal Insecticide, Fungicide and Rodenticide Act with respect to the registration of such products should be modified."

We presented a statement in Washington on April 9 and another in Memphis on April 16. The points treated in these statements will not be repeated here.

Obtaining pesticide tolerances from the Food and Drug Administration and comparable registrations from the U.S.D.A. requires a massive quantum of effort and data secured over a period of years. Any consideration to modify such registrations should be based on data which is very substantial.

The notice of public hearing by U.S.D.A. was apparently instigated by a U. S. Public Health Service press release of March 19, 1964. Public Health submitted testimony into the record on April 9 in Washington. It repeated that testimony on April 16 in Memphis. The statement by Public Health is represented by its report issued April 6, 1964. It is the only information in the record as of the termination of the Memphis hearing which links Endrin to the problem. It is therefore appropriate to consider this report which was twice inserted into the record.

II. The Occurrence of Annual Fish Kill is Not Supported by Reports Contemporaneous With The Events

The press release by the U. S. Public Health

Service, U. S. Department of Health, Education, and Welfare said that studies were made by it because of a series of fish deaths "involving millions of fish" taking place in Louisiana "each fall and winter since 1960."

There was no report of fish deaths "each fall and winter since 1960" until U. S. Public Health said so last month. Mr. Robert LeFleur gave a similar report to the Senate Subcommittee for Organization last week. These current reports would seem to be the only documentation that this fish kill is an annual event.

The routine reports of Public Health issued yearly do not support the conclusion that fish deaths occurred annually. (This point was discussed in our April 9 statement in Washington, and is not here further detailed.)

The routine reports of the Louisiana Wildlife and Fisheries Commission do not support the conclusion that fish deaths occurred annually. The 1960 fish deaths were characterized in the Louisiana Commission's Biennial Report as being "the most spectacular fish mortality ever noted in Louisiana." (Ninth Biennial Report, 1960-1961, Louisiana Wild Life and Fisheries Commission, p. 207.) A repetition of that event in 1961 to the extent of the currently estimated 275,000 dead fish would have deserved at least cursory comment. But the Louisiana Commission report for that year is silent as to any such occurrence.

It is important to establish accurately the pattern of fish deaths. The records made when the events occurred must be given credence. And they show intermittent kill. Such intermittent kill is inconsistent with increasing contamination by a persistent pesticide. Although we made this point on April 9 we consider it worthy of repetition.

III. X and Y are Not Two Chemicals According to Tests of the U. S. Public Health Service

The U. S. Public Health Service has stated that two compounds, designated X and Y, are invariably associated with Endrin and invariably in the same ratio with Endrin. Our own recent analyses of fish taken from the Mississippi River, as reported on April 9, showed neither Endrin nor X and Y. As of April 9, Public Health reported that two intermediates used in making Endrin have the same gas chromatographic retention time as X and Y. They therefore conclude that X and Y are these two intermediates. X and Y are asserted to not contribute to fish mortality and are not found by Public Health in fish treated with Endrin in the laboratory even when Endrin is found.

The statement as to the unvarying association of

X and Y with Endrin, both in quality and quantity, seems to be an implication by Public Health that significant quantities of Endrin along with intermediates X and Y are leaking from Velsicol's plant at Memphis.

The announcement by U. S. Public Health Service of an unvarying relationship between intermediates X and Y and Endrin in Baton Rouge requires adopting the practically incredible conclusion that these three compounds travel together about 500 miles down the Mississippi River; that Endrin then begins killing fish; that X and Y tag along in unvarying proportion irrespective of whether the substrate is water, mud, fat, muscle, blood, or anything else; that Endrin, tagged with X and Y, travels 500 miles without effect on fish intermediate to Baton Rouge; and that the average Endrin concentration in the water increases as the Endrin is diluted and adsorbed during its 500 mile journey. To be credited as facts, these anomalies require much more proof than mere similarity in retention time, a characteristic shared by many chemicals.

The fact is that Velsicol's plant cannot have contributed toxicant of any significance to the Mississippi because as publicly reported by Mr. Leary Jones, Tennessee Stream Pollution Control Director, fish have not been killed in Tennessee at Memphis or below except for one occurrence at Lake McKellar where death was caused by lack of oxygen. For some reason fish die at Baton Rouge where there is a large industrial complex. And they die in the winter when Endrin is least toxic.

Not only does the conclusion that two compounds can be unvaryingly associated with Endrin on a 500-mile journey down the Mississippi defy the knowledge gained from all our experience, but X and Y are not even two compounds. Dr. Rosen, of the U. S. Public Health Service, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, said on April 1, 1964, that what appear to be two peaks which have been called X and Y are really six or eight peaks when carefully resolved.

Incidentally, there are only three intermediates in Endrin production. One of them is Isodrin which would show a peak at or near Aldrin and not year X and Y.

U. S. Public Health in speaking of X, Y and Endrin said:

> "The probability that three unrelated chemicals could distribute themselves in such an identical manner in such diverse conditions seems remote."...
> (p. A-13, U. S. Public Health Report)

It would certainly be agreed by anyone that for 7 to 9 compounds, the probability of such an identical distribution would be much less than remote.

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IV. The Mississippi River is a Chlorination Factory

"The year 1960 was not quite two weeks old when the Division Headquarters in Baton Rouge began to receive frantic phone calls about the terrible tastes and odors in public water supplies drawn from the Mississippi River below Baton Rouge. Division biologists sampled the river and determined that a chemical, phenol, was creating this obnoxious condition. Phenol, by itself, is capable of creating a taste in water supplies in the incredibly small concentration of 0.01 parts per million. Since all public water supplies drawn from the Mississippi River are dosed with chlorine as an antiseptic measure, phenol mixed with the chlorine inside the water treatment plants formed a chlorophenol. Chlorophenols create tastes in water supplies in even smaller concentrations than phenols by themselves." (Ninth Biennial Report, 1960-1961, Louisiana Wild Life and Fisheries Commission, p. 197.)

"Analysis of oily, waxy, and greasy residues in water and bottom muds requires a great deal of time by the personnel of this Division.

"When received in the Baton Rouge laboratory, the "mud is dried, pulverized and weighed amounts are put into extraction thimbles. This thimble is suspended in a cylinder to which has been added a sufficient volume of solvent to remove all oil from the soil sample. Next, sulphur is removed with copper, and chromatographic treatment absorbs other impurities. The oil and solvent are then separated by distillation. Following this, the oil is weighed and identified by infra-red spectroscopy." (ibid. p. 201.)

The U. S. Public Health Service said: "No available evidence refutes Endrin as the causative agent." (p. A-13, Public Health Report.) But the facts show that there are enough petroleum products in the environment and mud to actually be weighed. The facts show that chlorination reactions actually occur in the river water. And the record already shows that phenols and oils can cause extremely critical conditions with respect to fish survival at about 1 ppm and less.

It is with reference to this oil and chemically polluted environment that Public Health's report states, at pages A-1 to A-3, that organic extracts of river mud are lethal.

The report cites an experiment.

"Several chloroform extracts of the bottom muds were

> "collected in the area of the fish kill. The first of these was from one liter of mud and weighed 41 mg. This extract was dissolved in 3 ml of acetone, and then 400 ml of pond water were added and mixed. A control was treated in a similar fashion, except no extract was present. The water containing the extract killed two young guppies in 48 and 72 hours. The fish were not observed at death, hence no description of toxicity symptoms are available. The controls of both species were unaffected." (U. S. Public Health Report, p. A-1 and A-2.)

The 41 mg. extract of this experiment in 400 ml. water represents 100 ppm of organic pollutants. This type of experiment shows that the 41 mg. of organic material extracted from the mud was toxic; and nothing more.

V. Etiological Considerations

1. Endrin Was Absent In The 1960-1961 Fish Kill

> "Extraction of organic compounds with carbon tetrachloride were made from bottom muds in the affected areas and the extracts subjected to infrared and paper chromatography analyses. The findings offered no clues to possible causes of mortality.

> "Mud samples and fresh water clams were sent to the Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, for analysis and possible identification of pesticides. Results were negative with respect to pesticides." (p. 7, U. S. Public Health Report.)

The above is quoted from Public Health's report with respect to work done in the area and at the time of the 1960-1961 fish kill. At that time, analyses for Endrin were at least as sensitive as 0.1 ppm, and by paper chromatography were more sensitive.

Endrin is now reported in fish at levels up to 6 ppm, more than 60 times what could have been detected when negative results were reported by both State and Federal workers.

Public Health concludes at page D-2 (Public Health Report):

> "Because of the many similarities between the fish kills in 1960, 1961 and 1962, and that which occurred in 1963, it is quite probable that the earlier kills were caused by the same toxic organic material responsible for the kill in 1963."

In view of this conclusion, the absence of pesticide when looked for by both State and Federal laboratories at a time when methods of sufficient sensitivity to detect their presence existed and were used, would point to some other causative factor than Endrin or any chlorinated pesticide. When this fact is combined with the observation that the symptoms of these dying fish are not symptoms exhibited by Endrin poisoning, then indeed the reason to look for another causative agency becomes compelling.

Incidentally, Public Health makes the comment that the symptoms of dying fish include gas and liquid distention of the alimentary tract, a fact not previously reported in the literature as far as they knew (p. 17, Public Health Report). This statement is not clear since distention is well known in the literature. Consider for example the symptoms described by Dr. Stanley W. Watson, U. S. Department of Interior, Fish and Wildlife Service, which are strikingly similar to those observed of fish dying in the Mississippi. In discussing a viral disease in a hatchery, which killed over 2,000,000 fish, he said:

> "Diseased fish were lethargic; hemorrhagic areas appeared at the base of the fins and in the isthmus; the stomach was distended and often filled with a milky fluid. . ." (American Fisheries Society, 83 (3) 331-341, 1953).

2. Possibility of Spurious Identifications

In the short time available to us we sought to experimentally define certain problems inherent in water analyses for insecticide. Three samples of chloroform were obtained from laboratory supply houses. Chloroform is a chlorinated hydrocarbon solvent used by Public Health in analyzing for insecticides. The three reagents were tested for chromatographic peaks. Two of the sources of chloroform showed chromatographic peaks as if Endrin were in them, and all sources showed peaks as if intermediates of Endrin were in them. This was chloroform taken from the bottle.

The problem of interference at trace levels is well recognized by scientists. The following is quoted from the abstract of a paper given to the American Chemical Society two weeks ago by Dr. A. A. Rosen, U. S. Public Health Service, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.

> "Paper chromatography shows both positive and negative interferences with both an aqueous and a nonaqueous solvent system. The two systems are complementary in providing identification. The gas chromatography procedure is more sensitive and tolerates more of the miscellaneous organics than do the other procedures. However, this method is also affected by negative and positive interferences. The latter can lead to spurious identifications of insecticides."

VI. Agricultural Chemicals Are Necessary

Agricultural chemicals are a necessary national resource; as essential to our life as oil and atomic energy. Chemical use is the difference between growing cotton or exporting wheat as opposed to soliciting Russia's aid for clothes and food. To subject this resource to waste is clearly contrary to our national interest. But many persons proceed to do just that by making casual, uninformed comment in derogation of these critical assets.

Even as responsible a paper as the New York Times said only a week ago, "Certainly the nation's overcapacity for food production is so great that any potential diminution of crops resulting from such pesticide restrictions would be a lesser risk than that arising from the haphazard use of the chemicals themselves." To say that chemical use on the farm is "haphazard" and to imply that our productive ability is independent of our chemical technology is unrealistic. The New York Times should rather ask why Russia imports food from us and not we from them; why chemical technology, and not rockets, is Russia's prime requisite; and above all, why agricultural chemical technology heads Russia's list of requirements.

The time is gone when we can allow casual comment, unknowledgeable opinion, and flippant views to motivate our research activities. The time is gone when we should consider analyses of less than a millionth of a part per billion, as Public Health does on page B-5 of its report. The time is gone when we should argue about how much pesticide there can be on the head of a pin.

Not Food and Drug, not Public Health, not U.S.D.A., and not industry; none may allow unfounded, unthinking utterances that trigger a massive response of waste. In the present climate, should anyone recklessly conjecture as to hazard, hundreds of scientists initiate programs either to prove or disprove the remark. We do not always need more scientists; we frequently need less conjecture.

Intelligent debate, factually based, is desirable and is to be encouraged. Even if it gets heated. Enlightenment by government, industry, editorialists, or anyone seeking fact, is good. But merely seeking to inflame is bad. We may not recklessly yell "fire" in a crowded theatre, and so may we not yell recklessly of pesticide hazard unless and until we get the facts. The stakes nationally and internationally are too high to allow irresponsible and precipitous action.

VII. Conclusion

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We submit that the facts and circumstances do not support the contention that Endrin (or any chlorinated pesticide) is responsible for the recent reports of fish kills on the Mississippi River. We further submit that any change in the present requirements under the Federal Insecticide, Fungicide and Rodenticide Act with respect to the registration of Endrin would be unwarranted.

* * *

SECOND STATEMENT
of
Velsicol Chemical Corporation
Relating to
Recent Reports of Fish Kills on The Mississippi River
Submitted Pursuant to
Notice of Public Hearing
Federal Register, April 2, 1964, Page 4723

Mr. Chairman, ladies and gentlemen, my name is Louis A. McLean. I am Secretary of Velsicol Chemical Corporation. I reside at 174 Woodland Avenue, Winnetka, Illinois.

Last Thursday in Washington we pointed out that the fish kill in the Atchafalaya Basin and in the Mississippi from Baton Rouge south in 1960 was reported as fish dropsy. The symptoms exhibited by the sick fish in those areas in the early winter of 1963 were reported as the same. Catfish we intentionally placed in Endrin-treated water did not exhibit the same symptoms. The symptoms of the river fish were not those known to be typical of any of the chlorinated hydrocarbons. Tests by others had eliminated the organo-phosphorous compounds. Perhaps, therefore, it is appropriate we direct our attention to other points which have been raised.

There was a suggestion that toxins might be entering the Mississippi at Memphis, perhaps from our plant, mysteriously causing fish deaths at Baton Rouge and south, but not killing fish between Memphis, Mississippi Mile 732, to Baton Rouge, Mile 228. Fortunately, last June when odors were noticed here near Cypress Creek for a short time one evening, an investigation followed. The cause of the temporary odor, which some described as being like pentachlorophenol, a material we do not use nor manufacture, was never determined. However, the State authorities did take samples of our effluent in June of 1963, and they demonstrate the practical impossibility of our effluent causing toxic effects in the Mississippi. More important, however, is the fact there have been no fish kills in the Mississippi near Memphis in recent years, except one in McKellar Lake through which our effluent does not pass. That kill was due to low oxygen content. It is elementary that misadventures with pesticides cause fish kills, if at all, at the point of entry, decreasing downstream. Entries of pesticides do not first create fish deaths 500 miles away.

The purported findings of pesticides in the Mississippi from St. Paul to New Orleans, reported by the Public Health Service representatives last Thursday, unfortunately, do not include examinations closely preceding the 1963 occurrence. Of greater importance is the fact the sampling and analytical methods used were developed by the Bureau of Sport Fisheries and Wildlife, proved unreliable, and have been largely abandoned by that Bureau. The method proved usable only for "rough quantitative determinations." One of the numerous difficulties was that different batches of the activated charcoal were found to produce varying amounts of artifacts. (I offer as an exhibit the paper presented at the Third Seminar on Biological Problems in Water Pollution, U. S. Public Health Service, Cincinnati, Ohio, August, 1962, entitled, "The Use of Carbon for Measuring Insecticides in Water Samples" by Charles VanVanlin and Burton J. Kallman, Bureau of Sport Fisheries and Wildlife.) Despite the inaccuracies of these methods, reports have been circulated attributing accuracy to this method of findings of less than 1 part per trillion.

The U. S. Public Health Service, Department of Health, Education, and Welfare reports its analyses of water in the Mississippi River for Endrin, in parts per trillion. (Table C, April 6, 1964, Report of Division of Water Supply and Pollution Control.) In considering data of this nature, the numbers reported should be placed in proper perspective. Everyone knows that a part per trillion is a small number; but it is startling to realize that the amount of DDT or toxaphene allowed on foods and acknowledged by the Food and

Drug Administration to be safe is actually seven million times more than a part per trillion (seven million parts per trillion). Although Endrin bears a zero tolerance on foods, it was granted by Food and Drug with an analytical sensitivity of 100,000 parts per trillion. That is to say, anything below 100,000 parts per trillion was acknowledged as zero and safe by the Food and Drug Administration. Even if it be assumed that the numbers shown by Public Health for Endrin in Mississippi River water is accurate, the average shown at New Orleans is less than 100 parts per trillion; or more than 1,000 times smaller than could even be seen by the most sensitive methods when Food and Drug originally allowed the use of Endrin on food with a zero tolerance. So, if any Endrin is present at all, U. S. Public Health Service numbers show amounts which are 1,000 times less than "zero" and 70,000 times less than the safe level for DDT or toxaphene on foods. The inference that such water is unsafe to drink by virtue of Endrin contamination can be drawn only if the facts are ignored.

It is gratifying to read in the newspapers that Mr. George P. Larrick of the Food and Drug Administration has assured the people of New Orleans that purported findings of Endrin in New Orleans water March 5th are "pharmacologically insignificant." The pharmacological insignificance of the reported findings is illustrated by the fact that, if true, it would require a city of a half million people each drinking the excessive amount of a gallon of water each day, containing 25 trillionths of Endrin, to collectively ingest one pound of Endrin in over twenty-six years.

Newspaper reports state that unnecessary concern has been generated in the citizens of Louisiana connected with the fishing industry. This is unfortunate. We found no Endrin in the Mississippi fish we examined. In the Ninth Biennial Report, the Louisiana Fish and Wildlife Commission, in speaking of the 1960 fish kill, noted:

> "The bottom fauna revealed an abundant food supply consisting of snails, clams, leeches, oligachaets, may fly niads, gammarids, fresh water shrimp, and chironomids."

The concluding paragraph of the on-the-scene report of the 1963 occurrence by Harry McHugh, thereafter published March 8, 1964, in the St. Mary and Franklin Banner-Tribune, the article sent to Audubon representatives and by them to the New York Times, contains this similar observation. It reads:

> "Whatever this poison is in the water, it does not appear to affect the fresh water shrimp in any way as they are in greater quantities than in recent years."

With the known susceptibility of fresh water shrimp, and the other fauna, to Endrin, Aldrin and Dieldrin, this abundance speaks eloquently against these chemicals being causative of kills of catfish during this abundance.

This abundance of food also militates against the theory the fish were required to live off their fat.

The catch of salt water shrimp for 1963 was at the maximum level of 80 million pounds. The Morgan City papers say it was so large the processors could not handle it. The commercial fresh water catch for Louisiana in 1962, the last year for which I have figures, was 14,489,000 pounds, a figure exceeded only once in the preceding seven years.

No doubt others, personally knowledgeable of the uses of Endrin on cotton and sugar fields will report here as to the lack of winter fish kills in those streams running parallel to the Mississippi and Atchafalaya. A simple fact of geography, however, should be noted. The Mississippi receives little water south of the Yazoo. Most cotton and sugar field drainage runs parallel to it.

The bottom of the Mississippi channel from Natchez south is below sea level. The Atchafalaya has been dredged well below sea level.throughout its length. Little water flows into the Atchafalaya from the Mississippi except during spring floods, especially now that the gates have been erected at

Old River. A little, but not much, water from the Mississippi enters the lower Atchafalaya Basin through the Port Allen Canal. In times of low water a wedge of sea water backs into the Atchafalaya Basin. It backs under the Mississippi to above Natchez creating a complex of stagnation, changing oxygen content, shock from varying degrees of salinity, and influx of organisms normally not present in such waters. At such times salt water intrusion into the wells of farms and water supplies of the towns near the lower part of the Atchafalaya Basin is a matter of daily comment in the newspapers of that area. The problem has been complicated by the dredging of the Wax Lake and other channels out from the Basin. These periods of low water and stagnation serve as a hotbed for generation of water blooms and their toxins, not just in the Basin, but also in impounded ponds not fed from the Basin. In October 1959 over 500 ducks were killed in one pond of the Rockefeller Refuge, although ducks in adjacent but separate ponds were completely unaffected. Salinity was over 13,000 ppm. Botulism was the cause. (Page 162, Eighth Biennial Report, Louisiana Wildlife and Fisheries Commission.)

Low water subjects the fish additionally to shock from quick temperature changes. A fish kill from Mobile Bay to the Texas Gulf occurred in November 1959 when a 48-degree drop was accompanied by strong north winds. The Louisiana

Wildlife and Fisheries Commission in its Eighth Biennial Report, 1958-59, stated at page 149:

> "Catastrophic mortalities of marine species due to sudden cold waves have been reported from southern Texas to the Carolina coasts. Texas scientists have reported shrimp, crab, and/or fish mortalities during the winters of 1940, 1941, 1947, 1948, 1949 and 1951, the most heavy damage being during 1940 and 1951."

Of one thing we can be certain. Fish kills in 1951 and prior years cannot be attributed to Endrin.

It is easier to injure than to heal. Accusations are more newsworthy than scientific disproofs. Unfortunately, argument makes ascertainment of truth more difficult. This witness has frequently urged that precipitous conclusions not be propagandized, but that full, cooperative, scientific inquiry be made before rumors and suppositions are circulated; that scientific studies be revealed in detail for evaluation by other scientists. (I submit as an exhibit a speech, "Point of Departure," given October 9, 1963, expanding on this need. I offer for evaluation "Final Report Investigations as Required By Federal Aid in Fish and Wildlife Restoration, Fire Ant Investigations," Oscar Dewberry, dated October 19, 1962, and "A synecological STudy of the Effects of the Fire Ant Eradication Program in Florida" by Robert

W. Murray, as presented to the 16th Annual Conference of the Southeastern Association of Game and Fish Commissioners, October 15-17, 1962, little known long-term studies countering popular misconception as to the fire ant control program.)

Only the scientific ascertainment of causes can serve as a basis for corrective action, if the causes are subject to correction by man. Much work remains to be done -- work of qualified scientists working to a common end.

Unfortunately, there are a few who even lament the absence of war and disease, lament the abundance of food because such things upset natural balance. At page 117 of the March issue of "American Scientist," Mr. Frank Egler, the gentleman referred to as an authority by Mrs. Desmond, who favored us with her statement last Friday in Washington, states:

> "We have removed the natural checks and balances due to war and disease. Disease no longer wipes out children; war no longer kills off the warriors and the civilian populations (though the greatest threats of war continue to exist); disease no longer keeps the old from getting much older."

At page 120 he states:

> "I refer specifically to those fields of science and technology (often involving more of the latter

"than the former) known as agriculture, forestry, horticulture, and certain aspects of medicine. Through these four fields runs a common strand, that of entomology. It is entomology which has spawned the field of 'Pest Control.' There is no phrase in this entire paper which is more loaded with emotionalism than this. It sets up a great evil; then destroys it. It creates both the dragon, and St. George. (The fire ant was not a pest until the commercial sprayers told the believing Department of Agriculture that it was.) It is the web-strand-crossings of entomology-agriculture, entomology-forestry, entomology-horticulture, and entomology-medicine (where insects have been the vectors of disease) that have served as the four major focal points for the entry of pesticides into the human ecosystem, and the spread therefrom."

No amount of scientific endeavor and cooperative research can be expected to convince everyone, including the gentleman who wrote the above quotation, that elimination of disease, providing adequate food and better welfare for man is desirable. The great majority of Americans, however, do not need to be convinced. The great majority of Americans are willing to listen and attempt to understand scientific data, if they are permitted to hear scientific truth through the din of precipitous accusations. Speaking for one member of the chemical industry, we stand ready to give full cooperation to the ascertainment of truth in areas where there are real questions of cause and effect. Those efforts, however, should not be dissipated by side investigations into situations which, on the facts, point to factors other than pesticides. We share a burden and privilege with those present, and many not present, to fully and scientifically determine fact and assure our fellow citizens that men of agriculture and the chemical industry are fully interested in pure and abundant food, good health and the welfare of man.

* * *

B. Lorant

FOURTH STATEMENT
of
Velsicol Chemical Corporation
Relating to
Recent Reports of Fish Kills on The Mississippi River

Mr. Chairman, ladies and gentlemen, my name is Louis A. McLean. I am Secretary of Velsicol Chemical Corporation. I reside at 174 Woodland Avenue, Winnetka, Illinois.

In a statement presented by this witness last week in Memphis, the need for cooperative research to determine causes of fish kills in the lower Mississippi, its estuarine waters, and in the lower Atchafalaya Basin was stressed. To emphasize further that need this paper is presented to illustrate some of the myriad factors which have not been brought to attention in the hearings in Washington and Memphis.

In Memphis this witness mentioned the fact the abundance of bottom fauna in the lower part of the Atchafalaya Basin did not support the theory that bottom feeding fish in the winters of 1960 and 1963 were required to live off their fat, supposedly containing stored-up toxicants sufficient to cause their deaths. A few of the many complicating factors were mentioned. At this time I offer as an exhibit a reprint taken from the July-August 1963 Louisiana Conservationist, published by the Louisiana Wildlife and Fisheries Commission, entitled, "The Atchafalaya Basin Crisis" by Grits Gresham. It stresses the adverse effects in the Basin of almost 3,000,000 barrels of brine discharged monthly by Basin oil wells, low water and silting resulting from the actions of the Army Engineers in creating the floodways to protect Baton Rouge and New Orleans and the dredging of ship canals through the Basin to accommodate the annual ten million tons of shipping.

Of the 5,175,000 dead fish estimated for the winter of 1963, 75,000 fresh-water bottom-feeders were reported near Baton Rouge-Port Allen and another 100,000 of the same in the Atchafalaya Basin. Five million of the estimate were marine fish located in the salty waters at the mouth of the Mississippi. April 1st at Taft Center this witness was advised most of them were menhaden. At page 8 of the April 6th Public Health Service report this is again emphasized by stating "whole schools of menhaden" were involved. At page 10 it is stated that numbers of other species were "insignificant." If we consider the habits of the menhaden, it becomes obvious these marine fish did not die because they were living off their fat, supposedly containing Endrin.

The menhaden has been of prime commercial importance since precolonial times. Little used for human food, its oil has many industrial uses. The meal is used as a fertilizer. Despite intensive fishing menhaden numbers do not seem to decrease. (John LaGorce, "Book of Fishes," 1952, National Geographic Society.) Their presence in given localities does fluctuate widely. The Ninth Biennial Report of the Louisiana Wildlife and Fisheries Commission at page 144 points out, the Louisiana catch reached a low in 1958, and an all-time high in 1961, following the estimated deaths of one million marine fish in the winter of 1960. The number caught in 1961 by Louisiana fishermen was approximately 1,177,505,000. The reported 5 million dead in 1963 is less than 1/2 of one-percent of that figure.

Considering the long-term prime commercial importance of the menhaden, the authorities know surprisingly little about it. On a few points, however, they are in agreement.

(1) It is not a bottom feeder.

(2) On the average, the female lays approximately 140,000 eggs.

(3) It travels in immense schools running into the millions.

(4) It sustains itself, not by eating other fish,

but by straining out small marine organisms, requiring the schools of fish to be on the constant move. It cannot survive staying in one locality long enough slowly to store up toxicants possibly occurring in infinitesimal amounts in that locality.

(5) It is the basic diet of predatory fish. To escape slaughter by blue fish, and other predators, entire schools frequently rush into shallow waters, smothering each other to death. Two such instances were observed in August 1962 by Harold L. Jacobs, Chairman of the Delaware Water Pollution Commission, at Old Landing at the mouth of Love Creek. ("Chemical Week," July 20, 1963.)

(6) The menhaden is subject to numerous diseases in addition to the "red tide" which annually kills hundreds of millions of fish in Gulf waters, including the menhaden.

The authorities do not seem to know whether or not the Gulf varieties of menhaden, after casting their eggs in late winter and early spring in estuarine waters, naturally succumb, as do many of their relatives in the herring family.

It is extremely unfortunate that although menhaden were reported to constitute the huge preponderance of the five million marine fish reported to have died in 1963 in the estuarine waters of the Mississippi, we have no reports of the symptoms displayed by them. We have no reports of a single examination of tissues of these fish, nor those estuarine waters, for the presence of Endrin, Aldrin or Dieldrin.

May I again suggest considerable research is required, including research on menhaden, before a conclusion is attempted that fresh-water bottom-feeders and surface-feeding menhaden all died because of supposed long-term storage of Endrin in their fat.)

* * *

MR. STEIN: Thank you, Mr. Lorant, for a very complete statement.

I think in your statement we certainly have an issue joined. In trying to solve this in the best way, I would like to make a suggestion. I had not seen this in the format it was in before and have not discussed this with the conferees. What we might do is to go through this to Page 2, where you have "Known Facts Refute the Instrumental Analyses." Then I would suggest that this might be taken up point by point.

We do not want to have this get out of hand, because I think it would take too long. However, in using the conference technique, we would ask a representative of the Public Health Service to comment, and then you can comment on his comments. Then the conferees can ask questions.

This is your presentation, Mr. Lorant, and in all cases you should have the last word on any comment that the Public Health Service representatives might want to make.

MR. LORANT: If I can think of one.

MR. STEIN: You will, to use the Velsicol vernacular, and that is literal.

What I think we should try to avoid, in order to do the best we can to get a clear expression of views, is that I do not think we should try to get a prolix argument back and forth.

MR. LORANT: Mr. Chairman, obviously this is a complex issue.

MR. STEIN: Yes.

MR. LORANT: And tremendously so. I trust and I did not mean to give the implication that it was not.

Sometimes we have to boil these down to the essence in order to get a presentation in line with the time available to us, and that is the reason I am not reading the four statements in their entirety.

MR. STEIN: I think the impact of your statement is apparent, and I wouldn't apologize for the format.

MR. LORANT: I wasn't apologizing. I was merely explaining.

MR. STEIN: Yes. However, you can, if you wish, call upon one of the people who has accompanied you, if you think he would be better suited to make a rejoinder.

I wonder if we can go down this with the conferees. I don't think the first paragraph, talking about the press release, needs any comment. Unless anyone has any comment, we can go along from there.

You then talk about the April 6th report implying that Endrin is asserted to be causing the problem in Louisiana and is originating from Endrin pollution at Memphis by virtue of Velsicol's effluent.

As far as I understood the statements here by representatives of the Public Health Service yesterday, they didn't just simply imply it. They said it, and they also said, as far as I know, that the Velsicol contribution was a substantial contribution, and not necessarily the whole cause.

With that, you may comment.

MR. LORANT: I would like to comment on that, Mr. Stein. I used the word "implied" for the reason that the April 6th report carried extensive information with respect to compounds X and Y and their unvarying association with Endrin on the trip down the Mississippi, because X and Y were stated by them to have been identified as intermediates in the production of Endrin.

Now, I noticed in the report issued as of May 5th that characterization of X and Y appearing in an unvarying proportion, regardless of the substrate, has been deleted, and, as far as I recall now, was not mentioned, although X and Y were stated to be indicators for Endrin in the original report.

That is why I used the term "implied," and when I wrote this I did not have the May 5th report to refer to.

I trust that explains it.

MR. STEIN: Unless any representatives of the Public Health Service want to comment on this at all? If not, we can go on.

I am trying to get to the substance of this, if I can.

MR. LORANT: All right.

MR. STEIN: I am not arguing with your statement.

MR. LORANT: I hope I am not arguing, Mr. Stein.

MR. STEIN: No.

MR. LORANT: I am trying to cite the facts, as I see them, and as we see them.

MR. STEIN: Yes.

Now, maybe the Public Health Service had better comment on this because I am a little confused.

Let me give you my explanation. As far as I recollect, they never made a statement that the X and Y were intermediate products.

MR. LORANT: Well, that is not so. They did.

MR. STEIN: Where is that?

MR. LORANT: They were identified as intermediate products having the same peak retention time as two intermediates which are supposed to have been used in Endrin production.

I can refer you to the May 5th report, although that is not specifically stated in there. That was testified to by Dr. Weinberger in Washington at the first hearing of the United States Department of Agriculture hearings on -- whenever it was.

MR. STEIN: All right. Unless there is some dispute, we will go along.

I think the conclusions are your conclusions. I don't know that we should have to discuss those now. Do you agree?

MR. LORANT: I have stated them as my conclusions.

MR. STEIN: All right. Let's go to the next point on Page 2.

"Known facts refute the instrumental analyses.

"The analyses of the Public Health Service were made by microcoulometric gas chromatography."

We may be able to save time without reading this again. There is a severe and direct criticism of the technique.

MR. LORANT: Pardon me.

MR. STEIN: Yes.

MR. LORANT: I would not characterize what I say as a severe and direct criticism of the technique. I could not do that, and that is not what I imply. What I imply is that the technique is not the end in itself. The chromatogram has not replaced common sense in our analyses of scientific problems. The chromatogram is a tool to be used along with all the other facts and circumstances in order to arrive at a judgment.

I feel that in the current situation, the analytical tool has become the king, and all other facts and circumstances have been relegated to a secondary position.

I started off with the concept that the fish must be better analysts than we are, even though we are very good analysts, and from that flows an awful lot of useful information. That is my position.

MR. STEIN: All right. Now, let's see whom we can get to come into this.

Dr. Tarzwell, who from the Service do you think would be appropriate for making a comment, if any, on this first paragraph?

DR. TARZWELL: Well, since this deals directly, I think, with our determination --

MR. STEIN: I think you had better come up.

DR. TARZWELL: Since this deals directly with the determinations of materials in fish tissues, I think we should call Dr. Mount and Dr. Mary Schaefer to comment on this point.

Could you folks come up, please?

MR. LORANT: I might point out that the microcoulometric analyses were run by the Atlanta offices, and not by the tests of these two people.

MR. STEIN: In that case, Dr. Grzenda, you did that, didn't you?

DR. GRZENDA: Our chemists did. Yes. I can comment on this.

MR. STEIN: All right. Will you come up? We are happy to oblige.

DR. GRZENDA: All right.

On the microcoulometric technique, this is not a fly-by-night technique. It is well documented in the literature. It is used by both Federal and State regulatory agencies for enforcement purposes, for pesticide residues in food.

I don't know if this is apropos to this discussion, but about two years ago I was involved in a pollution case in Alabama from another large insecticide corporation. I was called on to make a deposition in a court in Birmingham, Alabama.

The analyses which we produced were accepted in the deposition I prepared as legal evidence with the plaintiff, and were accepted by this chemical corporation.

The company's people sent one of their chemists to our laboratories in Atlanta. He worked with us in various jobs as a laboratory technician and as a gas chromatographic operator, so apparently they felt that our techniques were worthwhile, and they accepted our data in a court of law.

These are precisely the same techniques that we used in this case.

MR. LORANT: If I may comment and go on, please?

FROM THE FLOOR: The compounds were different. You are mentioning my name.

MR. STEIN: I am very sorry. I don't think we can permit discussion from the audience.

FROM THE FLOOR: Please ask him to identify the compounds.

DR. GRZENDA: All right. The compounds were organo-phosphorous insecticides, namely, parathion. However, we used the same instrumentation. We had a different detection cell, but the basic instrumentation, the microcoulometer, the combustion chamber, the chromatograph, everything was identical, even the cleanup procedure. Again, it was an organo-phosphorous insecticide, not a chlorinated hydrocarbon.

MR. STEIN: Mr. Lorant, would you care to comment on this?

MR. LORANT: Yes, sir.

Whatever the techniques that were being referred to, I certainly wasn't looking for chlorine, which is, as I understand it, the technique that was used at the Atlanta laboratory.

I want to make it clear. We use microcoulometric techniques, we use gas chromatography, and we use electron capture detectors as well.

All of these are tremendously useful tools. They accelerate the search fantastically. They allow for us to do in days what used to take years in research laboratories.

I do not, by any means, intend to deprecate that instrument or those techniques, but what I would like to point out is that when I analyze a sample from a Heptachlor plant and get zero parts per billion Endrin and 120,000 parts per billion Dieldrin, I am going to ask myself if the machine has gone wrong with this analysis, and I am not going to put it down as the Gospel until I have a lot more information about it. I am not going to put down, without extensive checking, that I find 77 million parts per billion Dieldrin at a plant that does not make Dieldrin, and the highest concentration of Endrin, the product we make, is less than 35 times that amount.

Now, right or wrong, we must question these things with extreme rigor. We can't let the analyst watching the needle control our destiny.

MR. STEIN: Mr. Lorant, we are going to ask questions. I would not like to cut off any discussion, but may I suggest that a lot of these points are covered, as I note, in the previous points. I think we could save time if we could confine the comment back and forth just to the material in that paragraph.

We will cover all the points at the end by the end of the statement, but I think this would be a more productive procedure.

Are there any comments or questions on this?

MR. LAFLEUR: I have a comment and one question of Mr. Lorant.

The first of two comments, Mr. Lorant, that I would like to make, and this is for your information, is that we have not observed these fish die-offs in the Mississippi River beginning at or near Baton Rouge. We have observed them as far up as Lake Providence, which is within some six or eight miles of the State line.

Secondly, you are reading from the Louisiana

Wildlife and Fisheries Commission Biennial 1962-1963 Report, that part of the biennial that pertains to the fish kill.

This part of the biennial was written some time in about mid-November, and there was a deadline for submission, which was December 1st, at which time a lot of this information which has since become available, whether we want to accept it or not at this time, was not available; but the chronological sequence of events proposition is what I am trying to get over to you.

MR. LORANT: Yes, I appreciate that.

My only thought there, or at least one of my thoughts, was that it was significant. The examination of the fish showed minor or insignificant amounts of insecticides, only in a small percentage of the fish; whereas we heard yesterday that the probability of finding 10 out of 10, as was asserted to have been done, was extremely high.

I was just trying to bring the two points together to the conferees, so that they could consider them.

MR. LAFLEUR: That is correct.

Now, I again repeat: The analysis that was done was done subsequent to the writing of that report.

The question I have for you, sir, is this: Yesterday we heard testimony here with respect to the sampling in the Velsicol vicinity, and I noted that the speaker repeatedly referred to samples that were split with Velsicol.

I wonder if you now have the results on your analyses of these materials?

MR. LORANT: I don't know if I have results or not in Chicago on those materials, those specific samples.

I can say that we have analyzed Cypress Creek and Wolf River, and we find that the concentration of pesticides that could be in the mud decreases at an extremely rapid rate to the point that at the intersection or confluence, or whatever it is called, of the Wolf River with the Mississippi, we find none.

MR. LAFLEUR: But you do not have the results on these samples that were split with you, Is that correct?

MR. LORANT: I don't have them with me. No.

MR. STEIN: It seems in working with other industries in various parts of the country, this has been a very effective technique.

I think what we have here are obviously physical facts which we hope are subject to measurements, and we have found the split sample technique to be the one that works rather well.

MR. LORANT: Oh, I am in full accord, and we would have been delighted to work with split samples.

Our request for samples on April 1st was not granted, and we did not have time, due to the pressure of hearings and what not, in the last few weeks, to consider those samples that were taken in the past few weeks.

DR. GRZENDA: Mr. Stein, I would like to point out that one of the samples we split with Velsicol was an in-plant sludge sample from their agitation basin. The presence of Dieldrin was verified in this sample by the microcoulometric technique, by I. R. Spectrophotometry, which Mr. Wood examined yesterday, and also by the nuclear magnetic resonance technique by Dr. Wilcox of Emory University, Department of Chemistry.

MR. LORANT: May I?

MR. STEIN: Go ahead.

MR. LORANT: Without being light or trivial on what I think is a very serious subject, and I know we all do, if I have a mound of hay and I apply a magnet to it and pull out the so-called needle, I don't call that a needle stack. It is still a hay stack.

The point I am making is if you qualitatively identify a proportion of a peak as being Dieldrin, this does not make the whole peak Dieldrin, and I can say that we have determined that this Dieldrin peak is largely preponderantly not Dieldrin.

MR. STEIN: I think this may be all right, but here we are getting into the next few paragraphs.

MR. SVORE: May I say something on this point?

MR. STEIN: Yes.

MR. SVORE: Would it be possible for you to contact your office and obtain copies of the results?

MR. LORANT: I tried to do that last night and, unfortunately, our analytical people are in Washington.

MR. SVORE: Well, I am sure that they recognize the importance of this conference and the information ought to be there.

Wouldn't there be somebody there who could transmit it to you over the phone?

MR. LORANT: Well, I thought I just gave you the information on this peak.

MR. SVORE: Did they take the results with them?

MR. LORANT: Pardon me. I don't think I recognized what you were asking for.

MR. SVORE: I was asking for a copy of the results of the split samples.

MR. LORANT: I don't know that we have those as yet, but I will be happy to run them if we don't have them and get the results to the conferees as soon as possible.

MR. STEIN: All right. Let's go on to the next point. I am sure the one thing Washington needs is a few more analysts.

The next point is that you did find Dieldrin in and around the Velsicol plant, and Velsicol indicates that they don't make Dieldrin. How did the Public Health Service find such large amounts?

Dr. Grzenda; do you want to comment on that one?

DR. GRZENDA: On the Dieldrin?

MR. STEIN: Yes.

DR. GRZENDA: Yes. Well, I am not a chemical engineer. I have spoken to several of them in other agencies other than our own, and they indicated they would expect quantities of Dieldrin to be produced in association with the manufacture of Endrin.

Also, it might even be possible that a whole batch of material that is being made into Endrin actually goes sour in the production and they wind up with Dieldrin, since they are stereoisomers..

Again, we got very little information on this from Mr. Anthony as to the processes at the corporation when we went there.

I understand again that Endrin is an oxidation product of Isodrin, and I have had chemists tell me that in the production of Isodrin, Aldrin is also produced.

Now, when Aldrin oxidizes, this is Dieldrin, so again, just postulating, it is quite possible during the oxidation of Isodrin, the quantities of Aldrin that are present in the Isodrin would oxidize to Dieldrin, just as the Isodrin oxidizes to Endrin.

MR. LORANT: Dieldrin and Endrin are Stereoisomers. I will be glad to give the schematic representation of their production as shown in the patent literature.

Our chief competitor is somewhere out here in the audience, I am sure, and I would rather not discuss process details, but as far as that which is in literature is concerned, I will be happy to discuss at this meeting.

I would like to say this, though: Heptachlor is considerably different. It is not a stereoisomer and in our Heptachlor plant, massive quantities of Dieldrin were found in the complete absence of Endrin.

Now, I have not taken the position that there is not a particle or an iota of Dieldrin capable of being formed in the Endrin process. What I am saying is this: That when I find only Dieldrin in the absence of Endrin, and having taken the position that chemicals related to the manufacture of Endrin travel 500 miles down the Mississippi River with it, that a great deal of activity must go into proving that this is Dieldrin, and when I find this Dieldrin in the

Heptachlor operation and no Endrin at all, and I find it in 35 times the concentration of sludge, this should give one cause to wonder before issuing a report.

MR. STEIN: Do you gentlemen have any questions?

(No response.)

MR. STEIN: Do you feel you have to go ahead, Dr. Grzenda? This will be the last one on this, before we go on to the next. Go ahead.

DR. GRZENDA: All right. The samples which were described with relation to Heptachlor were taken from one of those dumpster apparatuses.

Now, I don't know what was in there before, what this dumpster had been used for. I don't know if the contamination was probable. I do not know if this dumpster had been used to haul materials from the other plants.

Again, I just want to put it on record that these samples were taken from a dumpster, and I don't know if contamination did occur, but it might have.

MR. LORANT: One comment on that?

MR. STEIN: Certainly.

MR. LORANT: The significant point is that it was Dieldrin reported in massive quantities without even one part per billion Endrin being present.

MR. STEIN: I think we are going to terminate, unless there are any further questions here.

This is what I think we have to avoid. Otherwise, we will be here into next week.

MR. LORANT: Mr. Stein, if I get too argumentative, I wish you would repress me.

MR. STEIN: No. I think the views can be expressed without cutting anything off, just by a simple comment by a representative of the Public Health Service and a comment by you after that, and perhaps we can move on to the next point.

MR. LORANT: As a personal privilege, if I might, might I ask for a recess to get a glass of water?

MR. STEIN: Certainly. Let's have a five-minute recess.

MR. LORANT: Thank you very much.

(Whereupon a recess was had.)

MR. STEIN: May we reconvene, please?

I believe we can now go on to Paragraph B, which deals with the statement that there has been no fish kill reported in the Mississippi in or near Memphis, the area of supposed highest concentration of Endrin contamination.

Dr. Mount or Dr. Tarzwell, which one of you wants to comment on that?

DR. TARZWELL: Mr. Stein, I believe that Mr.

Lafleur has already commented on this, has he not?

MR. LAFLEUR: I don't go across the State line, Dr. Tarzwell. My jurisdiction ends at the State line, but I do go up as far as Providence and have gone that far.

DR. TARZWELL: Well, Dr. Mount, in his visit down there, was in the area of the river in Louisiana and he was not in the area of the river at Memphis, so we cannot state, I believe, one way or another in regard to this, since we were not there.

MR. JONES: What date was he there?

DR. TARZWELL: He was in Louisiana the first week in December.

Dr. Mount, did you wish to say something?

DR. MOUNT: Yes.

MR. STEIN: Dr. Mount.

DR. MOUNT: I would like only to comment, Mr. Chairman, that this is not the fact. There were reports of fish kills. Now, they may or may not have been confirmed, but it is not a fact that they were not reported.

MR. JONES: I checked with Game and Fish.

Is Mr. Stubbs still here? I meant to bring this out this morning while he was here. He was to take an early plane.

I checked with him yesterday. After the letter was received from the Secretary, Mr. Stubbs got on the radio and sent one of his boys to West Tennessee and checked with every Game and Fish officer covering about the last year.

I don't trust my memory that far. There were no reports to the Game and Fish Commission in Tennessee of dead fish in Tennessee waters, with the exception of the kill in McKellar Lake on September the 13th. There was a mass kill then due to sewage and zero oxygen down as deep as 18 feet. We have those records here. They have nothing to do with this particular State. If you want them in the record, we can put them in.

Now, I cannot accept the fact that the tugboat captain saw dead fish unless you get the tugboat captain in here to document the date.

We have gotten a number of kills that we know did occur that we cannot document, but I think the lawyers will agree that you can't proceed with a murder case until somebody finds a body or has a witness who saw the body to swear to it in court.

Maybe there were dead fish. I don't know, but I think this record should be clarified whether there were or were not dead fish, and not by an unconfirmed rumor from a tugboat captain.

MR. LORANT: If I may comment, in addition to that, the reports for the last four years of the Public Health Service show no fish kill in the Mississippi River at or near Memphis or below Memphis, except in Louisiana.

MR. STEIN: Mr. Lorant, you know, Mr. Jones reported on the murder case, and I feel that I might be qualified to talk about dead fish now and exchange the compliment; but, as I understood the statement made about the report on dead fish, these were pollution-caused fish kills, and I think it has been brought out many, many times, that there was no notion at that time that pesticides caused the fish kills. It might have been a disease. These reports are just a collation of reports made by the States. I think this is something that is fairly clear.

(Without objection several remarks made on pages 563, 576 and 577 were stricken from the record.)

MR. LORANT: Again, with respect to these reports, I heard Mr. Lafleur yesterday. There is a category in these reports for fish kills of unknown causes, and, in addition to that, the most spectacular fish kill that occurred in Louisiana in the year 1960-1961 was not even reported for the biennium of 1962. This is in the State report, which is not restricted to kills of any specific type.

So, as I say, when I say the reports do not corroborate the fish kill, I don't question that there have been fish kills. I am saying that the record does not show it.

MR. STEIN: Again, what I am trying to do as chairman is get at the facts here.

MR. LORANT: That's right.

MR. STEIN: I may be mistaken on this, but if I am not, let's see if we can agree on a brief statement. Again, we are dealing with physical facts. These were extensive fish kills in the Lower Mississippi in these years. So far as I know, regardless of what may appear in the Public Health Service report or the Louisiana report, whatever the ground rules were, if we have the people responsible in the State of Louisiana coming up and saying that millions of fish died in the Lower Mississippi for several years, I don't know that this should be an area about which we really have to get into dispute.

It seems to me passingly strange, Mr. Lorant, for someone to say that the analysis is going to govern the facts, as you did in your first statement, and I agree with this as a point, and then to come around and say because a fish kill was or was not reported in a particular book really is the controlling point on whether those fish did or did not die.

MR. LORANT: No. The reporting does not make the facts. The fact is the fact in any event.

However, a clear definition of the problem is necessary in order to appraise the cause, and it has been my position that as a supposition, one would not expect sporadic, intermittent kills to be caused by increasing contamination year by year.

Therefore, I have been perhaps a little bit emphatic in trying to stick to the facts of these fish kills and not just glibly saying, "Ten million fish killed over the last four years," and that's the end of the problem.

Now, let's figure out who killed these ten million fish. Five million were menhaden. Not a one was sampled or tested or looked at, as far as I can determine.

MR. STEIN: May I do this? I certainly don't want to inhibit this, but you do refer to menhaden later on. May we take that up in its course?

By the way, I notice that you have capitalized the "menhaden," whereas "catfish" and "shad" have small letters.

(Laughter.)

MR. LORANT: No comment.

MR. STEIN: Are there any other comments?

(No response.)

MR. STEIN: If not, let's go to your next point. I think I will identify the points by just reading the first two sentences:

> "Public Health's report shows endrin could not have been carried the 500 miles from Memphis to Baton Rouge via the Mississippi River. Endrin is not soluble in water and is absorbed in solids."

Dr. Mount or Dr. Tarzwell, do you want to answer that, or comment on it?

DR. TARZWELL: Dr. Mount.

DR. MOUNT: I don't believe I have any answer, Mr. Stein. I would only wonder how our reports showed that it could not have been carried that far.

MR. LORANT: In the April 6th report, X and Y were characterized as intermediates in Endrin manufacture and were characterized as occurring in an unvarying proportion with Endrin, to the point that if you found X and Y, you didn't have to look for Endrin because you know it was there. In fact, you knew how much was there.

Now, in the analyses shown by Public Health as of May 5th, they show as much as 116,000 parts per billion in Cypress Creek, and a few miles downriver zero parts per billion, both in the mud and in the water.

In the April 6th report, mud samples are alluded to, but are not shown. It is stated that X and Y occur in the same relationship to Endrin in the mud as it does in the substrate of animal life, and so forth, water, but there were no analyses shown and I wondered about that.

Yesterday the gentleman did report on nine locations of mud samples taken around this area, as I understood it. He read off the names of the rivers, and he said that these data were just made available to him. Five of those areas were negative as to Endrin, and four of them, as I heard the figures very rapidly -- and I would be happy to look at them again for the moment -- show both Dieldrin and Endrin in approximately equivalent proportion, at about four parts per billion.

Now, analyses in mud of about four parts per billion are at a level where there is a great deal of conjecture, and again I say that these analyses, the rapid decrease in the concentration over a few miles, and the fact that the fish are not dying there -- all of these show that Endrin is not being carried down the river.

Now, Dr. Mount said yesterday that we need look no further for the cause of the fish kill. I don't hold him to that statement, because I think on reflection he might say otherwise, but it is easy to find a cause and say, "That's it, and let's hang the culprit, and now that we have found the cause everybody is happy," and if next year there is a fish kill, we will know it was the wrong cause, but we have been irreparably damaged. If there is no fish kill, well, it's just like 1962.

MR. STEIN: Mr. Lorant, if you are irreparably damaged, you would be the first industry I know of that has been irreparably damaged by our activities in water pollution control, and I have been here for a long time.

I really do want to say this: I ask you to bear with us. I do not want to impede anything anyone might say and I am all for giving full freedom of expression, but I think it might help if we were to confine our remarks to the points made in the paragraph.

However, I don't object to X and Y being brought in at any appropriate point.

MR. LORANT: Those were factors which I consider are relevant in considering whether or not it can be considered that Endrin is being carried down the river, so to that point I was talking, and if I became irrelevant, I am sorry.

MR. STEIN: I think Dr. Grzenda wanted to say something. Go ahead.

DR. GRZENDA: I would like to make a few comments about the solubility. Dr. Lorant's comment is that "Endrin is not soluble in water and is absorbed in solids."

I would like to point out that there are a variety of organic carriers which have increased solubility -- in other words, the materials could be in fats. As a matter of fact, in Memphis, in the lower reaches of Cypress Creek, there is an oil company which discharges waste into Cypress Creek. At the Cypress Creek pumping station, there are globs of fat floating on top of the water. There are suspended fats in the water, and Endrin is quite soluble in fats. These materials would be a perfect vehicle for the downstream transport, and the same is true of similar materials.

MR. LORANT: The April 6th report of Public

Health shows 41 milligrams, if I remember the number, per kilo of organic solids in the mud around where the fish kill was occurring.

Now, let's see -- 41 milligrams per kilo, what would that be in parts per billion?

DR. MOUNT: 41,000.

MR. LORANT: 41,000 parts per billion, of which they found 4, if that is the same locale, to be Endrin.

Now, I would like to ask this question: Is it the contention of the United States Public Health Service Water Pollution Section that the Endrin is being carried downstream in the organic pollutants, hydrocarbons, and the like?

MR. STEIN: Does anyone of you want to answer that?

DR. MOUNT: May I?

MR. STEIN: Yes, go ahead.

DR. MOUNT: I don't think that, at least speaking for my own work, and I suspect that I speak for the other investigators, we have proposed the method by which Endrin is carried down the river. I think what I have proposed and concluded is that there was enough Endrin in the blood of those catfish to have killed them.

Now, I have not seen any indication that this is not true.

MR. LORANT: Dr. Mount, in the dying catfish you took from the Mississippi, how many samples did you have?

DR. MOUNT: You know that.

MR. LORANT: Three, and on that you drew a bar graph showing the range at which the blood level of Endrin would be in a dying catfish. That graph was reproduced in the May 5th report.

Now, apropos of this amount of Endrin being carried down, we heard several times yesterday -- and if you will bear with me, Mr. Stein, this is a point I thought about yesterday, but, of course, would not have been allowed the floor had I requested it. I would like to make this point. There has been tremendous conjecture that this is the minimum amount of Endrin when they report a number, because maybe 90 percent is passing on through and they are not finding it.

Well, they use a cylinder so like so (indicating). Why don't they hook another cylinder on and test that hypothesis, having two in series, and see if this conjecture of losing 90 percent is indeed a fact?

Has that been done, Dr. Mount?

DR. MOUNT: I think Dr. Breidenbach can answer that.

MR. STEIN: Do you want to get Dr. Breidenbach up here?

Again, we are going very far afield with this.

MR. LORANT: I am trying to answer. I have finished my statement.

MR. STEIN: Mr. Lorant, with all deference to you, if you think that is responsive to the question I will go along with you, but I think this conjecture was a new idea and I think you are privileged to put this in, but we can be here for a long time with it. We are trying to expedite this.

Now, maybe we can have one comment on this before we go into the specific points, which I hope will move more rapidly.

The next point is this: The laboratory of Velsicol presumably analyzed catfish recently caught in the Mississippi both above and below Memphis. Using the techniques employed by the Public Health Service, these fish contained no Endrin, and so forth.

Dr. Mount, do you want to comment on that briefly?

DR. MOUNT: If I were asked for an opinion about the content of Endrin in the Mississippi River catfish at the time these samples were taken, which I presume was some time in March or April, I would have said exactly the same thing, because you will see in the tables and my testimony yesterday that the buffalo were negative for Endrin, and I think that I would agree wholeheartedly that that would be the case.

MR. LORANT: To clarify any possible misconception, these were channel catfish that we analyzed.

I would like to ask Dr. Mount a question, if I might. Why is it that these fish in an environment that is supposed to be contaminated with Endrin build up Endrin in their bodies, and it is not there a month or so later? If Endrin is a contaminant and the persistent material it is supposed to be, that it is talked about being and is alleged to be, why do the fish not show it now, and why would you expect them not to show it now?

MR. STEIN: Do you want to answer that, Dr. Mount?

DR. MOUNT: I don't believe that I would be ready to buy yet that it is a constant or persistent concentration. I don't think we have enough data to say that. We do know that Endrin will not stay in the fish body forever. Thank God for that.

MR. LORANT: But it was the theory of Public Health that they exist on their fat in the lean months, and it is this which caused the kill.

DR. MOUNT: I do not believe that has ever been stated.

MR. STEIN: It hasn't been stated. I wonder if we could confine ourselves to the report. I haven't seen that.

Now, I don't know if this is a theory either. Let's see if we can be specific, Dr. Mount and Dr. Tarzwell, please.

The next point is:

> "The theory of the Public Health Service that endrin is contained in the mud around Baton Rouge and that the bottom feeders are primarily affected is refuted by the fact that of the 5,175,000 fish estimated to have been killed in 1963, 5,000,000, or 96.6% of the total, are salt water Menhaden which are not bottom feeders."

Do you want to comment on that, Dr. Mount?

DR. MOUNT: Well, again, in any formal or official reports I do not believe that we have in any way tied the death of these fish to the bottom sediments. It may have been within this one report that at least three of the four major fish affected in fresh water were bottom fish, but beyond that I don't believe we have any conjecture that it is coming from the mud or the water or the suspended silt.

MR. STEIN: Thank you, Dr. Mount.

Mr. Lorant, do you have a comment?

MR. LORANT: Unfortunately, my memory fails me as to where this reference comes from, so I will have to wait until I get the specific reference.

MR. STEIN: Thank you.

The next one reads:

> "The contemporaneous Federal and State reports refute the assertion of annual fish kill. For the four year period in question the Louisiana state report discloses no such fish kill in 1961 and the federal reports disclose no such fish kill as to 1961 and 1962."

I think we discussed that. The Federal reports come from the State. I would like to call on Mr. Lafleur, if I may, on this one.

MR. LAFLEUR: This is a peculiar type of thing that we had never been confronted with prior to November 1960. The fish kill in 1960 was rather severe. In the winter of 1961 and again in the winter of 1962, it was less severe. In the winter of 1963 it equaled that of 1960, if, in fact, it did not exceed it.

MR. STEIN: Do you have any comments, Mr. Lorant?

MR. LORANT: Well, the only comment I would like to make, Mr. Lafleur, I assume these figures at Page 2 are your best appraisal of the proportionate fish kill each year?

MR. LAFLEUR: That's right.

MR. STEIN: The next paragraph reads as follows:

"The fish kills in 1961 and 1962 are asserted to be nominal as compared to 1960 and 1963. This pattern of intermittent fish deaths is inconsistent with the conclusion that the cause is a persistent, increasing contaminant having a pattern of annual recurrence."

Dr. Mount, you may have answered that in part before. Do you want to comment again?

DR. MOUNT: No, I don't believe I do.

MR. STEIN: Do you believe you have answered that sufficiently before?

DR. MOUNT: Yes.

MR. STEIN: Thank you.

Paragraph 4 mentions William A. Tompkins. He isn't here now, is he?

MR. LORANT: No, sir, he is not. I read his complete statement, though.

MR. STEIN: I recognize that. However, I want to read Paragraph 4:

B. Lorant

"William A. Tompkins, Chief Aquatic Biologist, Massachusetts Division of Fish and Game, reported after experimentation: 'The reported observances of the fish kill occurring in the Mississippi River do not parallel the symptomatology of endrin or related pesticides.'"

Dr. Mount, I wish you would confine yourself to the statement alone. Since Mr. Tompkins is not here to defend himself or make any comment, we will, of course, accept this as put in, but just for your comment, assume this is a flat statement.

DR. MOUNT: As stated in my description yesterday, we used 50 channel catfish obtained from Arkansas weighing from one-half to one pound.

In approximately 95 to 99 percent of those 50 channel catfish which were exposed to a wide range of Endrin concentrations in our laboratory, we observed exactly the same symptoms that I observed in dying channel catfish in the Mississippi River. These include hyperactivity, increased ventilation rate, convulsions, loss of equilibrium, excessive distention of the abdominal cavity due to water and gases in the stomach and intestines, and some hemorrhaging around the mouth and fins.

In addition, we made careful microscopic examinations of the kidneys of dying catfish taken from the river. There was obvious and glaring damage in the glomerulus of the kidney, and last Saturday I examined ten sections from catfish in the laboratory that had died, and the exact same damage was noted in the glomerulus in these fish.

MR. STEIN: Dr. Mount, just before you finish, to be very definite, you don't agree with the statement that "The reported observances of the fish kill occurring in the Mississippi River do not parallel the symptomatology of Endrin or related pesticides"? You believe it does?

DR. MOUNT: Yes, sir. I believe it does.

MR. STEIN: All right. Thank you.

MR. LORANT: In the April 6th report, which was apparently written prior to the time you concluded this work, Dr. Mount, it is very specifically stated to be the view of Public Health that the symptoms of fish dying in the Mississippi were identical to those that were killed in the laboratory.

Now, Mr. Lafleur testified in Washington and in Baton Rouge that an acute kill from Endrin is different from the kill that he has observed in the Mississippi River, and he does have an explanation for that which I am sure he can give better than I; but the fish that you killed in the laboratory were acute kill.

How can we reconcile the views of Mr. Lafleur, who says that the symptoms are different from those of yours, which says they are identical?

MR. STEIN: Do you want to say something on that, Mr. Lafleur, or Dr. Mount? This is a question.

Dr. Mount, go ahead.

DR. MOUNT: We have noted that if one exposes channel catfish to Endrin in a deep, narrow container that has not much surface area in relation to the total volume, that some of the symptoms are not observed. Especially, we do not see as much gas distention of the abdominal cavity.

Now, we have assumed that in all probability this may be due to gases and waters accidentally injected during the convulsion stage. Obviously, if the fish do not come to the surface, they are going to have a rougher time getting gas into their stomachs.

I would also indicate that all species do not show all of the same symptoms.

Finally, I would like to indicate in regard to Mr. Lorant's comment about acute toxicity. We have exposed fish up to 44 days' duration to a wide range of concentrations. We have not been able to produce mortality after fifteen days, except for the one case where we lost fish at twenty-one days, and this was associated with a fifteen percent increase in the concentration.

In my doctoral work as published by the Fish and Wildlife Service, I indicated in there that beyond approximately thirty days we did not get any mortality in continuously renewed concentrations, and these exposures were carried to eleven months. So I feel, in my opinion, that we have covered the period of time in which we might expect mortality in fish.

I would also add that the fish which died at fifteen days and at twenty-one days, as are indicated on the figure that I showed yesterday, probably represent about as long an exposure that will produce death as you will expect to get in regard to catfish.

MR. LORANT: My only comment, Mr. Stein, is that with respect to the container making a difference, I understood Mr. Lafleur's observations were all made in the field, and that his comparison of a distinction in the symptoms was in natural environment, and not in laboratory environment.

MR. STEIN: Mr. Lafleur?

MR. LAFLEUR: The observations with respect to the acute kill as compared to the chronic kills, the typical thing we are interested in primarily at this time are as follows, and these are our observations:

In the case of the acute kills, they are species nonpreferential. They kill everything in sight that swims, as far as we can tell, from the most tolerant to the most sensitive.

In the case of the chronic kill, they are species preferential. For example, the game fish, bluegills, bass and so forth, were conspicuous by their absence in these fresh water areas.

MR. LORANT: May I comment?

MR. STEIN: Go ahead, but let me suggest this: I am just talking about the methodology and I certainly do not want to interrupt your train of thought. I am certainly prepared to be here until everyone has had his say.

I might point out that in the comment or the rejoinder in a situation of this kind, if we end by a question, we necessarily are going to prolong this.

Go ahead.

MR. LORANT: I was just going to comment that the identical symptoms of Dr. Mount were by acute kill, and at the same time he just said that chronic kill is not something he observed up to eleven months.

MR. STEIN: The next point is:

"The reported fish kills in Louisiana occurred not in the summer when the river water is warm but in the late fall and winter when the river water is cold. Endrin is much less toxic in cold water than in warm water."

Dr. Tarzwell?

DR. TARZWELL: I have a question I would just like to ask.

Is this last statement based on the work of Dr. Max Katz?

MR. LORANT: Yes, sir.

DR. TARZWELL: Dr. Max Katz did this work at my suggestion and under my direction at Oregon State University, where we have a laboratory, where we work cooperatively with this group.

Endrin acts much less rapidly in cold water than it does in warm water. In experiments that we did with DDT, we found that DDT in comparable amounts was just as toxic at 5 degrees Centigrade as it was at 25 degrees Centigrade, the difference being that at 25 degrees Centigrade the kill occurred much sooner; whereas if we gave longer exposure, more than seven days and up to ten days, the same concentration of DDT killed the fish at 5 degrees as it did at 25.

MR. LORANT: A very short comment?

MR. STEIN: Go ahead.

MR. LORANT: The only comment I would like to make is that the paper upon which this comment is based is cited in one of the four documents that I have introduced into the record, and I would imagine that that paper will be officially recognized by the committee and taken into account in its discussion on Endrin.

It likewise refers to an earlier work, I believe of -- I don't recall his name. It might also be with the same organization, and it verifies this fact, but the ultimate facts are in the paper. We need not discuss it here.

MR. JONES: Murray, may I say something on that?

MR. STEIN: Yes.

MR. JONES: You talk about toxicity. Toxicity over so many hours, or so many days, is the normal way of reporting it. Something that took longer to kill would be considered less toxic by your standard method of reporting. If it took four days, the odds are one to four that he could get out, but if he could be killed in 24 hours, a slug would kill him as he goes by.

I think you would consider it less toxic if you get him in a closed container. It may take a month to kill him. He is just as dead perhaps, but you would normally consider it less toxic.

I think there is nothing wrong with that statement.

MR. STEIN: The next statement is one of the few that confuses me. I don't quite understand this.

> "Endrin comprises only about 2% of all the chlorinated hydrocarbon agricultural pesticides used in the lower Mississippi cotton and sugar cane area in question. It is used in the summer. Endrin thus cannot be a major pollutant."

I don't know if anyone wants to comment on that.

MR. LORANT: If it is not clear, I certainly would like to.

MR. STEIN: Let me give you my reaction to this. If Endrin is only 2 percent, as Dr. Tarzwell pointed out, it is the most deadly of all materials to fish, and 2 percent might be enough. If it is only used in the summer, it may hang around long enough to kill them in the winter.

I don't think your statement follows like the night to day that Endrin thus cannot be a major pollutant.

MR. LORANT: Then you need a few more factors.

Toxaphene, a very effective insecticide, is also toxic to fish. It is used in the cotton belt to the extent of an estimated 15 times the amount of Endrin that is used.

DDT, also toxic to fish, is used in the cotton belt to the extent of about 20 times, if I recall, the amount that Endrin is used.

Now, if we are talking about 100 percent of chlorinated insecticides put out in these fields and the 2 percent of Endrin is the thing that runs into the river and the thing that is found, then we have to ask ourselves, "Are we finding artifacts, or just what are we finding?"

I am not proposing that I know the answer, but I am proposing that there are tremendous questions here that are unanswered.

These insecticides which are used in far greater amounts than Endrin are found in much lesser amounts than Endrin, or are reported in much lesser amounts.

MR. STEIN: I understand your point, and I don't know that we go right to the methodology, but as I understand it, Dr. Mount found what he considered lethal doses of Endrin in the fish in the river and in the laboratory.

I don't suppose you characterize these lethal amounts as artifacts, do you?

MR. LORANT: I don't know. I don't have enough information on this to characterize them in any way.

MR. STEIN: Well, if no one else wants to comment on that, the next one I think we can summarize by reading a part of it.

> "Endrin in the Mississippi River is reported by Public Health analysts in parts per trillion. ... One part per trillion is so infinitesimal as to defy comprehension let alone detection."

Now, I don't know if Dr. Breidenbach should be the man to comment on that. Dr. Breidenbach, would you come up? Did you read this statement, or do you want me to read it again?

DR. BREIDENBACH: I heard it.

MR. STEIN: All right.

DR. BREIDENBACH: If we were talking about one gallon of water or one liter of water, I would agree with his statement.

We are, however, talking about five thousand gallons of water, and at a concentration of 1 part, 25 parts, 100 parts per trillion in 5,000 gallons of water we are not talking about an infinitesimal amount, but an amount which we can measure repeatedly by chromatography, by electron capture and microcoulometrically, and confirmatory spectra with infrared analysis.

MR. STEIN: Mr. Lorant?

MR. LORANT: I know that it is possible to take a sample and research the heck out of it, if you will, and get an awful lot of information on it. The numbers that you get from that sample by these corroborative methods carry a great deal of validity -- not certainty, but a great deal of validity.

I would like to point out, however, that this rigorous research approach for each of these samples is not carried out. I would add only the final comment that in the type of charcoal that is recommended for use in these water analyses by Public Health, without touching them to the water and following the procedure of Endrin analysis, I don't know whether a chromatographic peak which would indicate the presence of Endrin in this charcoal can be gotten.

DR. BREIDENBACH: May I comment?

MR. STEIN: All right, but just one more.

DR. BREIDENBACH: All right.

It is very disconcerting to have implied that analyses of this type with activated carbon, using chloroform, would be conducted in any reputable laboratory without adequate control procedures for these materials.

Our carbon is sampled routinely and extracted with our chloroform, which is redistilled. We run these residues through our analytical procedure routine. We run them through all of our analytical procedure routines so as to assure ourselves that the artifacts, which have been mentioned here, do not exist and do not influence the results which we report.

The other comment I would like to make is that it has been stated that these rigorous corroborative analyses have not been applied to all of the samples which I have run.

This is in error. Every positive analysis for Endrin which we have run we have corroborated to our satisfaction as professional chemists, dealing with this for a number of years.

MR. LORANT: Only one last point. I meant no adverse implication, Doctor.

My one last question is, why do we now question that there may be ten times as much as what you are finding if all this rigorous work has been done?

DR. BREIDENBACH: Well --

MR. STEIN: Certainly you can have this prolonged, as you see.

MR. LORANT: I couldn't help but ask that, because it bothers me.

MR. STEIN: Mr. Lorant, if your last comment is always going to end in a question -- I am just talking about methodology to you --

MR. LORANT: I apologize.

MR. STEIN: Go ahead. The question was asked, Dr. Breidenbach.

DR. BREIDENBACH: The carbon filter method was begun as a means of obtaining a quantitative sample some fifteen years ago by Francis Middleton and Dr. Rosen, who is in the office.

Up until eight or ten months ago, it was not possible technically to gather and purify the pesticides from these materials. The use of thin layer chromatography helps us do this.

Now, we know and have known for some short period of time that the carbon filter method cannot be considered a strictly quantitative method, and we are at the present time conducting both developmental and applied research to find out exactly how quantitative it is. I should expect before another year has passed we will know whether this figure of ten times is indeed ten times, or one hundred times, whether it is an exact figure. Our information to date is that practical analysis indicates that the concentrations we report may be as much as ten times lower than the amount that is actually present.

MR. STEIN: Thank you.

MR. LORANT: I would only respectfully request that the committee consider the publication in Science

Magazine of September 1963, and the recent Annual Report of the United States Public Health Service on Water Pollution, as well as the analytical technique -- unfortunately, I don't have the reference here -- which describes technically the method.

I think it would be helpful to the conference for them to consider that.

MR. STEIN: All right. Thank you.

I think we can get over the next two points in agreement.

Paragraph 8 says:

> "There is no record of fish kills in the Mississippi River near Memphis in the last decade, except for one in Lake McKellar and that was due to low oxygen content."

I think that has been discussed.

The next point reads as follows:

> "It is hypothesized by the Public Health Service that the fish die in the winter because they accumulate endrin in their fat over a long period of time and then mobilize it by utilizing their fat when river food is scarce. This is contradicted by the report of the Louisiana Wild Life and Fisheries Commission, which says that

"bottom food was plentiful at the time of the 1960-1961 fish kill."

That has been discussed. There has been no such hypothesis presented here.

MR. LORANT: You mean today, in this conference?

MR. STEIN: That is right, and the conferees are dealing with the material presented to them.

MR. LORANT: I suggest that that was the theory that was proposed.

MR. STEIN: I have not seen that theory in writing anywhere, and I think I have looked at the literature.

MR. JONES: That is mentioned somewhere, Murray. I don't know where. I will find it.

MR. STEIN: See if you can find it. I think it has been discussed. I mean, it is not before us.

MR. LORANT: Would it be in the April 6th report, Dr. Mount?

DR. MOUNT: I don't think it is.

MR. LORANT: One of the theories that has been advanced for the seasonal pattern of the kills is that the fish build up relatively high concentrations of Endrin in their fatty tissues over a period of time. During the winter when the fish do not feed extensively, these fatty tissues are reabsorbed and the accumulations of Endrin may be leaked into the blood at lethal levels.

That is from the April 6th United States Department of Health, Education, and Welfare report.

MR. STEIN: If you equate that, sir, with the phrase, "It has been hypothesized by the Public Health Service that the fish die" with "one of the theories advanced is," I just leave it at that.

MR. LORANT: All right.

MR. STEIN: All right.

Next is Paragraph 10:

"Whatever is causing the fish kill it has not affected fauna normally very sensitive to endrin."

Who wants to comment on that?

DR. MOUNT: I think before I could say anything, Mr. Stein, we would need to know what fauna he is referring to, and what his source of information is.

MR. STEIN: All right.

MR. LORANT: The source of information primarily is the United States Public Health Service, that 95 percent of the fish dying were channel catfish, and that the few remaining were shad and one or two others; but that was the only mention of any kill.

MR. STEIN: Is this sufficient for you to answer that or not?

DR. MOUNT: Not exactly, except that we know now that channel catfish in laboratory exposures have been killed at concentrations less than a half a part per billion. This is more sensitive than bluegills, but formerly was thought to be one of the most sensitive species.

We also were able to run a few tests with bullheads, in which we killed them in 48 hours at .25 parts per billion.

Both of these species, of course, were killed in the river.

MR. STEIN: Do you have any comment on that?

MR. LORANT: I think so.

MR. STEIN: Yes. Next is Paragraph 11, which reads:

> "Although sufficiently sensitive testing methods were employed, neither the U. S. Public Health Service nor the Louisiana State scientists were able to detect the presence of endrin or other agricultural insecticides in the 1960-61 fish kill investigation. The symptoms in 1963-64 were the same as those observed in 1960-61. The 1960-61 fish kill was reported to be caused by dropsy after isolating the causative organism."

Now, Dr. Tarzwell?

DR. TARZWELL: This reference to the 1960-61 fish kill I believe is a reference to a letter that I sent to the Louisiana group in January 1961.

We did attempt at that time from specimens, samples of mud and samples of clams sent to us by Mr. Biglane and Mr. Lafleur to see if we could find some cause of the fish kill.

Subsequent information, the data that we did secure on a 1963-64 kill indicating Endrin, indicates that -- well, at that time we didn't have the methods. We didn't have the instrumentation to carry it out and find it. We couldn't have found it because we just didn't have procedures and methods at that time for doing it, and as a result it was reported that we did not know the cause of the kill. We were still groping and wondering what it could be.

With reference to the last sentence in this Item No. 11, I believe the testimony given yesterday by the Fish and Wildlife Service shows that in their findings -- this is in the record -- this kill was not caused by dropsy.

MR. LORANT: Well, as to the last comment, while it does not appear in my prepared statement, the organism was isolated by the Louisiana State people and not by any Federal people.

Now, as to methodology, the fish kill in 1963-64 was verified by paper chromatography and I. R. spectroscopy.

In 1955, when Endrin was granted its tolerance, it was deemed to be pharmacologically insignificant that it was 100,000 parts per trillion -- that was the sensitivity of the method then used. If in 1955 we could analyze at a 10th of a part per million, and in 1959 or thereabouts we had paper chromatography which analysts say is very sensitive and we had I. R. spectroscopy, and if they could corroborate the 1963-64 kill, they were sufficiently sensitive to find the levels that were present in 1960-61 if the cause was the same. The levels, I might add, that have been reported, are as high as 6 parts per million, or 60 times that of what the sensitivity of the analytical technique was in 1955.

MR. STEIN: All right, Dr. Tarzwell, the last one.

DR. TARZWELL: The technique for extraction from flesh, the technique working with the materials that might be in organisms, were not developed at that time, and as for instrumentation, well, we didn't have it in our section.

You know, there is such a thing as money, and we didn't have these things there, and I am sorry to say that we don't always get new things because we have a budget. We are trying to get them and we do get them as rapidly as we can, and that time we went as far as we could with what we had.

MR. LORANT: The Ninth Biennial Report says that

I. R. spectroscopy and paper chromatography were tried, but negative results were obtained.

In our laboratory we have been analyzing at levels as low as a tenth of a part per million since about perhaps 1953, or perhaps a little earlier than that. The methodology, I submit, did exist.

MR. STEIN: By the way, Mr. Lorant, we have had Dr. Schaefer up here for a long time, and I think she has an impulse to say something now.

DR. SCHAEFER: I wanted to say something on that one.

Although infrared has been available all these years and was available then, concentrations in milligram quantities are needed for infrared, and it has just been within the last few months that we are down to microgram quantities in testing with infrared.

It would not have been possible for any analyst, I think, to have done assays for Endrin in the concentrations in which they have found it in this study, regardless of the equipment they had available.

MR. LORANT: At a tenth of a part per million?

DR. SCHAEFER: Well, at a tenth of a part per million they might have. Yes, sir.

MR. LORANT: I am talking about the animal life.

DR. SCHAEFER: Methods were not available for extracting material, as Dr. Tarzwell said, from biological media.

MR. LORANT: I don't think that is the case, Doctor, but I will have to refer to the literature to substantiate that.

MR. STEIN: All right. Now, let's get to the last point.

> "According to the Public Health Service, the fish received by Dr. Snieszko and examined by him and his staff were one cat fish and two shad. No Menhaden were examined despite the fact that Menhaden comprised 96.6% of the fish estimated to have been killed in 1963-64."

I assume Dr. Snieszko is not here, is he?

DR. MOUNT: I think the Fish and Wildlife Service representatives from yesterday ought to be able to speak on that point. I believe that is already in the testimony.

MR. STEIN: Yes. Maybe you can do this to save time, and if they want to expand, go ahead, if you recall what the situation is.

DR. MOUNT: To the best of my recollection, Dr. Meyer from Stuttgart testified yesterday in regard to menhaden and said that it was not due to dropsy.

MR. LORANT: My only comment is that the source of my statement is Dr. Weinberger in his testimony in Washington at the U.S.D.A. hearing.

MR. STEIN: Now, the last point I am sure we all can agree on, that:

> "Velsicol urges that the problem be very carefully defined and that conclusions be drawn from all of the pertinent circumstances. We are willing to cooperate in any investigation, in Louisiana where the problem exists, in Tennessee where our plant is, or elsewhere."

I don't know whether you meant to imply that by "in Louisiana where the problem exists," that there may not be a problem elsewhere, such as Tennessee?

MR. LORANT: I meant no such implication.

I merely would like to make this comment, if we are at the end.

MR. STEIN: Yes. Go right ahead.

MR. LORANT: I do not mean to imply by anything that I have said that insecticides are ever to be used with abandon. They are certainly to be used with the caution that their toxicity requires, but I do very sincerely submit that they comprise a national resource which we should not abate needlessly. It is a tool that we require to feed ourselves and to help feed the world.

I said in one of these statements, and this is my last comment, that pesticides and agricultural chemicals are the difference between our shipping wheat to Russia or asking them to ship wheat to us, and I believe that sincerely.

MR. STEIN: Mr. Lorant, before you leave, I think on principle we may be able to agree.

I don't think anyone thinks it should be used with abandon, but wouldn't you agree that processors and formulators of pesticides should also not discharge them as wastes with abandon?

MR. LORANT: I believe that the products should be handled with caution to the point where they do not endanger public health, and where they do not impair our environment.

MR. STEIN: Sir, if you mean by the last statement, "impair our environment," what you say, let me point out the statute we are operating under.

The statute we are operating under deals with the protection of health or welfare. Welfare includes agricultural uses, municipal water supplies, industrial water supplies, recreation, fish aquatic life and wildlife, and so forth. I think if any of these are endangered under our statute, this comes within our province to be investigated, controlled and abated if it relates to water pollution.

We are not just dealing with protection of public health in this statute.

MR. LORANT: I can't comment on your statement.

MR. JONES: Murray, I have one question. Our statute covers the same thing too.

This is a question, though, that was discussed a few minutes ago that was not clarified, or I missed it somewhere. It deals with this X and Y, which frankly I don't know as much about as I need to, but I finally found my place in the report and I think it can be clarified pretty quickly.

Does the Public Health Service still stand behind this initial statement on page A-12 of the blue book of April the 6th, that the X and Y were invariably closely related to the presence of Endrin, and that the quantity of X and Y was unvaried?

MR. STEIN: Dr. Schaefer?

DR. SCHAEFER: They were not unvarying. They were always there in any of the samples of dying fish from the Mississippi.

I will not say that the ratio of X to Y to Endrin was always the same, because it was not. We have also seen it in other things, where the ratio has not been the same in the Mississippi River. I saw it in shrimp also. I saw it in a dead duck also. The ratio is not always the same, but they are always there, and we have not found them in any animal species from any other geographical area.

MR. JONES: The reason this comes up is that there are other tests going on there.

If this were true and still is the stand of the Service as stated here, in view of a lot of other investigations going on I thought we ought to clarify it here.

DR. SCHAEFER: No, they are not always in the same ratio.

MR. STEIN: Are there any further comments?

MR. WOOD: Murray?

MR. STEIN: Mr. Wood.

MR. WOOD: Mr. Lorant, earlier in your statement you referred to an examination of catfish and mud in the Memphis area and stated that there was no Endrin found.

Did you find anything at all at the peak retention time of Endrin on the chromatographs?

MR. LORANT: I spoke very rapidly. I don't think I have ever seen the chromatogram which was reported to me by our analytical people.

MR. WOOD: Thank you.

MR. STEIN: Are there any other comments or questions?

(No response.)

MR. STEIN: Thank you, Mr. Lorant. You really have been very helpful, at least to me, in presenting the issues, and I think to the conference.

MR. LORANT: We appreciate the opportunity of being here.

MR. STEIN: I do believe, and I say this to you and to the audience, that it is just by joining issues like this that we can hope to arrive at a judgment on this. I would suspect that since this is going to and has come up, it looks to me like we probably will have as long an association with your industry as we have had with many others. If we do I hope you enjoy it as much as I do.

MR. LORANT: I pledge our cooperation.

MR. STEIN: Thank you.

MR. JONES: I think that I have called on all the representatives from Tennessee.

There are some others here. One I think yesterday morning was prepared to make a statement and decided not to.

Have I missed anyone from Tennessee whom we asked to come down?

MR. ROBERTS: Mr. Chairman?

MR. STEIN: Yes. What is your name.

MR. ROBERTS: My name is A. L. Roberts.

MR. STEIN: Are you from Tennessee?

MR. ROBERTS: Yes, sir, but I am not in any official capacity. I am just here as an individual.

MR. STEIN: I think under the rules we have to direct your inquiry to Mr. Jones, and see if Mr. Jones will invite you to participate.

MR. ROBERTS: I am not asking by way of participation, but was directing a question to the United States Health Service. It is simply this:

Has there been anything done by way of the investigation as to the effect of Endrin or any of the other toxic materials directly affecting human beings in the use or misuse of this material in the Cypress Creek or the Memphis area?

MR. STEIN: I don't think we are going to entertain many questions, but that is a pertinent one.

MR. JONES: Yes. We will throw that in for Tennessee.

MR. STEIN: As far as I know, the full report of the findings of the Public Health Service is contained in the report you have received.

Now, if there are any other statements on that --

MR. JONES: I don't think there is much reference to humans, is there?

MR. TRYGG: This matter I think will be covered in some testimony I will give for Louisiana on the status of this particular point.

MR. STEIN: All right. Will you hold that, please?

Mr. Jones, do you have anything more from Tennessee?

MR. JONES: I think that covers everything from Tennessee.

MR. MC LEAN: I am Louis A. McLean, Secretary for Velsicol Chemical.

This is a little different kind of question. What are the arrangements to be made with the reporter?

MR. STEIN: As I told you, Mr. Zimmer represents a commercial reporting firm that we do business with after arms length negotiation. We will make the report available to you, the full transcript, after this goes through the vagaries of Government printing. I can't give you any date less than three months, or guarantee a date.

Now, if you want a copy, you are perfectly at liberty to handle your own negotiations with Mr. Zimmer.

MR. MC LEAN: Thank you. I understand we have already made the arrangements.

MR. JONES: That is the full transcript, Murray? Someone else was asking me yesterday.

MR. STEIN: Yes.

MR. JONES: We will have copies, if you need any.

MR. STEIN: Is that all?

(No response.)

MR. STEIN: In that case, I think at the present time we will call on Arkansas. Mr. Wood?

MR. WOOD: We have two statements to come from representation in Arkansas outside of the Commission itself.

The first is Mr. Grover C. Dowell, University of Arkansas Extension Entomologist.

Mr. Dowell.

MR. DOWELL: Mr. Stein, may I make a comment off the record?

MR. STEIN: Yes, you may.

(Discussion off the record.)

STATEMENT OF GROVER C. DOWELL, UNIVERSITY OF ARKANSAS EXTENSION ENTOMOLOGIST, P. O. BOX 391, LITTLE ROCK, ARKANSAS

MR. DOWELL: My name is Grover C. Dowell, University of Arkansas Extension Entomologist. My mailing address is P. O. Box 391, Little Rock, Arkansas.

The need for the use of agricultural chemicals is obvious. Control of insects attacking dwellings and industrial sites is a necessity. Control of arthropods that transmit human diseases would not be forfeited by any thinking citizen of the United States. Insecticides used for control of arthropods that jeopardize crop production and livestock production are thoroughly tested before they are put on the market for sale. Insecticides used for control of insects inside homes are thoroughly screened by scientists in industry and are closely scrutinized by the University personnel before making recommendations for their use.

The safety record on the use of insecticides is a point of envy by scientists in other disciplines. For instance, aspirin, a compound commonly found in homes, causes more deaths each year than agricultural insecticides. It is a well-known fact that insecticides are potentially hazardous, but it is gratifying to the scientists and to the public that use these materials that a strong educational program on the safe and intelligent use of insecticides has been effective. There is hardly a family in the United States that doesn't use some type of insecticide during the year. Yet, these users realize that insecticides are potentially hazardous and they use them with discretion. This is a tribute to the user, to the scientist in industry that developed the compound and to University and U.S.D.A. personnel who tested them for effectiveness and later recommended particular uses for them. Many things are potentially hazardous but experience, training and alertness have allowed people to make effective use of potentially hazardous items.

The X-ray machine is a potentially hazardous piece of equipment. Misuse would be sure death to a person. However, doctors and X-ray technicians have learned to use the machine safely and effectively. Insecticides, like X-ray machines, are potentially hazardous but may be used safely.

University of Arkansas entomologists approach the area of insect control on an as-needed basis. They do not recommend blind insecticide applications. They recommend insecticide usage when insects are numerous enough to cause economic damage. University of Arkansas entomologists' approach to insect control is one of a conservative nature.

The recommended uses are scientifically based. This conservative approach minimizes the accidental spillage of toxic materials and reduces environmental contamination. An example of the Arkansas approach to the conservative use of insecticides is exemplified by the cotton insect control program.

Each cotton field should be, and usually is, surveyed weekly. Populations of pest insects are tolerated until damage is an immediate threat. About 80 percent of the cotton acreage is scouted by farmers and an additional 10 percent is done by scouts trained and supervised by University of Arkansas entomologists and county agents. Their work sets standards of performance for scouting cotton. Their detailed records, dating from 1949, give a picture of cotton insect control practice and serve as a guide both to extension and research.

Limited insecticide applications to actual need as shown by individual field surveys has many advantages, of which reduced environmental contamination is one. It has one major disadvantage; it can only be accomplished through a persistent and major educational effort.

The problems that have arisen in the past few months from the killing of fish in the Lower Mississippi River Basin have not been clearly determined. Aldrin, Dieldrin and Endrin have been seriously implicated by some agencies.

G. C. Dowell

I would like to attempt to present the problem in what I consider its true perspective. There are two problems confronting the people of the United States in regards to the use of pesticides. The number one problem is accidental spillage of pesticides. These accidents are caused by: (1) misuse, (2) machine difficulties, (3) carelessness, (4) misinformation, and (5) total ignorance.

The second problem is one of environmental contamination. When pesticides are used in the environment they can be detected in minute quantities if sensitive analytical tools are available for recovery. In the case of Aldrin, Dieldrin and Endrin the sensitive analytical tools are available. With all problems there are solutions. I would like to propose some considerations for alleviating the problems.

Problem number one, based on the best usage data available is a very minor problem. The approach to avoiding the misuse of pesticides is not strengthened by legislative procedures. However, a strong aggressive educational program will practically eliminate this problem. The educational program has been in effect for years, efforts have been accelerated, and with the use and cooperation of the press, radio and TV much more progress can be made.

The solution to the second problem is considerably more difficult. There are many things that cause environmental contamination. A strong research program will have to be put into effect to determine what levels of agricultural pesticide residues, raw sewage, household detergents, industrial chemical disposal, antibiotics taken by humans and disposed by the sewage route are acceptable in our environment.

Once these residue levels are established for these environmental contaminants, then a strong monitoring system will have to be put into effect. Based on the best scientific facts that are available, parts per billion and trillion of insecticides afford no residual human health, fish or wildlife hazards. In the future I would plead with all agencies to avoid incriminating individual products because sensitive analytical methods for residue recoveries are available. As these materials with sensitive analytical methods are incriminated, other materials that do not have sensitive analytical methods developed to detect minute levels are allowed to contaminate the environment. Let us endeavor to establish acceptable residue levels for all environmental contaminants, develop a monitoring system and give the public of the United States scientific facts and not fantasies derived from misinformation.

G. C. Dowell

This is not on the paper, but I would like to make this comment: That in 1955 and 1956, cotton entomologists were confronted with a problem of boll weevil resistance to chlorinated hydrocarbon insecticides.

This meant that we had to leave materials that we were acquainted with the use of and go to more toxic materials, or a different group of materials that are toxic.

Now, we entomologists, especially in the Delta, were very much concerned about what effect these insecticides would have on humans as well as other things, such as fish and wildlife.

The United States Public Health Service came to our rescue. They released a man -- I believe it was Dr. Quimby -- who came to the Delta around Stoneville, Mississippi, and did some very detailed work. This work that he did certainly set up standards for us to use in our educational program.

Now, it is this type of cooperation that we like. It is this type of cooperation that makes America what it is, and the United States what it is.

I understand that the United States Public Health Service has come today to L.S.U., and there is one difference. The phosphate insecticides report is published. The report from L.S.U. has not been put into the record.

Thank you.

MR. TRYGG: I have a question.

MR. STEIN: Go right ahead.

MR. TRYGG: I notice, Mr. Dowell, that you have dwelled considerably on the safety aspect of the insecticide program in Arkansas.

My specific question is: Have there been any deaths among scouts considered as possibly resulting from exposure to insecticides? There is a rumor that there have been.

MR. DOWELL: Death from what?

MR. TRYGG: You referred to the term "scouts."

MR. DOWELL: Cotton scouts?

MR. TRYGG: Yes. Have there been any deaths in scouts that have been considered possibly being from the insecticides?

MR. DOWELL: That is in error.

MR. TRYGG: Excuse me. What is in error?

MR. DOWELL: The statement or the question that you asked, has a scout died from exposure to insecticides. This is not the case. I personally supervise from 120 to 130 young college students each year in our cotton insect scouting program, and during all this time we have had one boy who got phosphate poisoning, and he was out in the field when it came time to re-treat it.

The pilot didn't know he was out there. The boy didn't know the field was about to be treated, and he was subjected to quite a heavy load of a phosphate insecticide, but he had temporary dizziness. He recovered. He didn't have to take any atropine of any kind. He was temporarily sick. Fortunately, it happened about the last day of the scouting season.

No deaths have occurred from exposure to insecticides with the cotton insect scouts that worked in our University of Arkansas Extension Scouting Program.

MR. TRYGG: I would like to talk to you about this report after the meeting sometime.

MR. DOWELL: I would be pleased, because it is there.

MR. STEIN: Mr. Svore?

MR. SVORE: I want to commend you, Mr. Dowell, upon your fine statement. There is one question.

You said the No. 1 problem is accidental spillage of pesticides. Did you mean that this is the most serious problem?

MR. DOWELL: No, no, no. Earlier I said there are basically two problems. One problem is accidental spillage. The second problem is that of environment contamination. Then I go on down to accidental spillage.

I can see how you can mix the two there, because I am dwelling with a total problem.

MR. SVORE: I didn't think you meant it the way I was interpreting it, but I just wanted to make it clear.

MR. STEIN: Are there any further questions?

(No response.)

MR. STEIN: If not, thank you, Mr. Dowell.

MR. DOWELL: Thank you.

MR. STEIN: Mr. Wood?

MR. WOOD: The second statement will be presented by Mr. Sumner McAllister, General Manager of the Agricultural Chemicals Division of the Shell Chemical Company.

MR. STEIN: Mr. McAllister, how long will you take?

MR. MC ALLISTER: As long as you want.

MR. STEIN: The reason I say this is that we are going to have to break for lunch. I don't want to break in the midst of your presentation.

MR. MC ALLISTER: I think I can be through with it.

MR. STEIN: All right. Fine.

STATEMENT OF SUMNER H. MC ALLISTER, GENERAL MANAGER, AGRICULTURAL CHEMICALS DIVISION, SHELL CHEMICAL COMPANY

MR. MC ALLISTER: Mr. Chairman, conference members, ladies and gentlemen:

I am going to read a statement.

MR. STEIN: Would you mind identifying yourself?

MR. MC ALLISTER: My name is Sumner H. McAllister. I am at present the General Manager of the Agricultural Chemicals Division of the Shell Chemical Company and former Research Director. I reside in Greenwich, Connecticut.

I am not going to read at this time all of the supporting evidence. We have a brochure which has been given to the conference members, which substantiates, or the data is in substantiation of the statements which I am about to make.

I should also like to point out that there have been two other very large and voluminous documents submitted in the record of the agricultural hearings in Washington and at Baton Rouge. I think copies of those documents are here, and we can, of course, use them for reference, if there are a lot of questions involved.

If the Chairman wants this written into the record here for its availability, we can read it into the record. We intend to read it into the record or submit it as a part of my statement.

MR. STEIN: How long is that?

MR. MC ALLISTER: Eighteen pages.

MR. STEIN: We will print that as if read. Just submit it. All right.

MR. MC ALLISTER: My statement comes in three parts. I am now going to read the first part.

Mr. Chairman:

Shell Chemical Company welcomes the opportunity to appear at this conference as the guest of the Arkansas delegation. We are vitally concerned with the problem as we are one of the manufacturers of Endrin, which is alleged to be responsible for killing some 10 million fish in the Mississippi Basin over a period of three to four years. This is our third appearance before a governmental agency in the last month, the other two being before the Department of Agriculture hearings at Washington, D. C., on April 10, and at Baton Rouge on April 23. At those hearings we presented a large amount of pertinent data to support our position. This information is available for reference but will not be presented here. Copies, however, will be supplied the conferees on request.

Our statement today will deal with 4 major points which we believe to be important to this inquiry. These are:

1. What were the actual fish kills, when did they occur, and do we have sufficient information to discuss objectively the cause and effect relationships at this time?

2. What is the analytical and toxicological data available which relate the kills to Endrin rather than to other possible contaminants; and, if some fish kills are due to Endrin, did these arise from normal agricultural use, accidental contamination, or run-off from manufacturing or formulating plants.

3. Is there any hazard to the general public due to Endrin in the drinking water derived from the Mississippi?

4. Would a steady diet of Mississippi catfish present any hazard to public health?

Statements have been made in the press and on television that Endrin is the cause of the deaths of ten million fish in the lower Mississippi and Atchafalaya Rivers. However, as near as can be determined from data presented by State and Federal agencies, the fish kills referred to occurred over the period since 1960, and two-thirds or more of the fish killed were menhaden that died in the brackish estuary waters of these rivers. Apparently, no toxicological studies and no determinations of chemical residues are yet available on the menhaden. Thus it does not appear justified to extrapolate the catfish data to the menhaden either for 1963 or for the years since 1960. Work by Dr. R. F. Nigrelli and others provide other explanations for massive kills of menhaden, both in the Mississippi estuaries and elsewhere, prior to the sale of the pesticide in question.

If we eliminate the menhaden kill from discussion, and no pesticide residue measurements on fish or water related to earlier catfish kills have been reported, we are left with a relatively small kill in 1963-1964 of catfish and other fresh water species on which there are some data. The discussion then, to be scientific and objective, must confine itself to these few data relating to isolated kills. It would be a gross extrapolation to correlate "10 million fish kills" with Endrin or any other pesticide at this time. We obviously need additional facts and we trust that these will be forthcoming during the year. Shell stands ready to cooperate in any such study. We have already had crews in the field and in the laboratory collecting and analyzing samples to try and track down the source of "pollution."

The basis for assuming that Endrin is the cause of

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the fresh water fish kills is that blood from dead or drying Mississippi catfish contained an amount of Endrin sufficient to kill them, as determined by experiments made in the Taft Laboratory where Endrin was added to water in varying amounts over periods ranging from hours to several days. There are some discrepancies in these data and there is, of course, considerable argument in the literature as to what constitutes a lethal dosage of Endrin to fish in their natural environment. Nevertheless, from all the analytical evidence available, some of which may be conflicting but only in detail, it would appear that the amount of Endrin normally found in the Mississippi River water is far below the concentration necessary to kill fish. Until the experiments now in progress, at Taft Center involving fish that are exposed to small concentrations over a long period of time to see if a toxic build-up can occur, are completed, no decision as to the kills having resulted from normal agricultural run-off is at all justified.

There is some evidence to support the view that the dead fish which contain Endrin were killed by a temporary, relatively mass effect characterized by spillage or other misadventure, and we trust that explanation of such occurrences can be brought to light so that remedial measures can be taken, if justified by a calm appraisal of the facts.

Information as to other potential toxicants which might be responsible for fish kills encountered is sadly lacking at this time. This arises in part from the lack of analytical techniques as sensitive as those for Endrin. That other toxic contaminants, both domestic and industrial, are present, is well known and documented from past experience and end use data. Such possibilities cannot be ignored as contributing either directly to some of the recorded kills or as part of the total pollution problem in which Endrin is only a minor factor.

Silt and mud analyses, coupled with an increasing number of samples of water from the tributaries of the Mississippi, provide clues as to the possible sources of contamination. Recent experiments in which water saturated with Endrin was exposed to several types of clay showed that the Endrin was proportioned into the clay at a ratio of over 1000 to 1. Thus drainage from agricultural lands under normal end-use conditions does not seem to be a possible source of the "massive fish kills."

There is ample toxicological data, collected over the past 10 years, to support the present registration of Endrin as an insecticide on food crops and to guide the manufacturers and end users as to the safety precautions necessary. From these it is possible to evaluate the hazard, if there is any, to the public from either the drinking water or from eating game and commercial fish.

The amount of Endrin in the Mississippi River water at New Orleans is almost below that detectable by the most precise analytical measurements. During the most critical period, it averages less than 0.08 parts per billion. Based on the toxicity data for Endrin, this provides a safety factor in excess of 12,000. For most of the year, the Endrin concerntration is a fraction of this level and the margin of safety is substantially greater.

In this connection it should be emphasized that although we can now detect Endrin in fractions of a part per billion, the biological data on which safety in food is determined is still the same.

One should not be alarmed at finding parts per trillion of a substance which has no effect whatever on mammals at ten thousand times that level. After all, toxicity depends upon the dosage rate as is so readily demonstrated by common table salt, and the margin of safety in the case of Endrin is truly far greater than in many common foods or beverages. Instead of being alarmed, we should be reassured because we now have established what is present.

We have and are continuing to analyze catfish and other fish taken alive from the river. While there are some variations in the amount of chlorinated hydrocarbons present in the flesh, depending on the site of the sample, none contain sufficient amounts for concern, and in most cases Endrin is found in only traces, if at all. From a practical standpoint a live fish cannot contain enough Endrin to pose any real threat to a person eating it as the sensitivity of the two is so different. Until there is more evidence to the contrary, it would be irresponsible for any reputable person to frighten people into believing that eating catfish or similar game fish is dangerous.

The Food and Drug Administration has already given us assurance that the fish and water are safe.

In conclusion, let me summarize that the problem with which we are concerned is a very complicated one involving several scientific disciplines. There is insufficient evidence to correlate the 1963 or early "massive fish kills" in both fresh and brackish water with the insecticide Endrin or any other insecticide. There is some evidence that some fresh-water fish have been killed by Endrin but, if so, this is most likely attributable to accidental spillage, or intermittent contamination, not to normal agricultural run-off. There is no evidence of a critical problem from the public health standpoint from either fish or drinking water which would justify hasty action.

In view of the value to agriculture of the products involved and the precedents which might be established by ill-advised or precipitous action, we recommend that the studies be continued and sufficient time allowed so that proper scientific evaluation can be made. In the meantime, all parties concerned should try to avoid inflammatory and unjustified statements. As scientists and as responsible leaders in both industry and government, we owe this to ourselves and to the general public.

MR. STEIN: Thank you, Mr. McAllister.

MR. MC ALLISTER: I have two more statements.

MR. STEIN: Do you want to read them all before we adjourn?

MR. MC ALLISTER: They are pretty short, so if you don't mind, I would like to.

MR. STEIN: Go right ahead.

MR. MC ALLISTER: In connection with this occlusion of Endrin on soil, certain experiments were made at our laboratory, and I might say that we are continuing to examine on a daily basis mud, fish and water samples. We are just as concerned about finding out the facts as is the Public Health Service.

I think that this experiment is rather interesting to the agricultural people, and therefore I am going to read it into the record.

Because of the low concentration of the pesticides found in water as compared to the levels found in mud, an experiment was conducted to determine the partitioning of Endrin between water and mud. For comparison purposes, muds from Deer Creek (Mississippi), the Platte River (Nebraska), and a typical clay carrier (Attaclay), used in formulating dusts and granules, were selected for study.

In the experiment, Endrin crystals were added to water and allowed to come to equilibrium on a wrist action shaker at 23°C for 24 hours. The resulting saturated solution was found to contain 160 ppb. The mud, or clay, selected was added to the saturated solution and agitated for one hour. The mixture was then centrifuged, filtered, and the Endrin content of the filtrate determined. The results are given in the following table:

OBSERVED SELECTIVE PARTITIONING OF
ENDRIN INTO SOLIDS FROM WATER

ENDRIN CONTENT OF WATER, PARTS PER BILLION			
BEFORE SOLIDS WERE ADDED	AFTER ADDITION OF HIGH-ORGANIC CONTENT MUD	AFTER ADDITION OF LOW-ORGANIC-CONTENT MUD	AFTER ADDITION OF ATTACLAY DUST
160	0.022	0.208	0.167

The partition coefficient is a measure of the tendency of the Endrin to move from one phase to another. If the concentration of Endrin in water is taken as unity, then the partition coefficient represents the concentration of Endrin adsorbed on the solid, at equilibrium.

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The following table shows the partition coefficient obtained from this experiment.

SOURCE OF MATERIAL	CONTAINED ORGANIC MATTER, %	PARTITION COEFFICIENT
Deer Creek Mud	20 (estimated)	7300
Platte River Mud	10	770
Clay Carrier (Attaclay)	0	960

These data indicate that more than 99.8 percent of the Endrin present in a water-mud system would be sorbed onto the mud. Thus, the mud apparently acts as a natural purifying agent by removing the Endrin from solution. In addition, these data indicate that the greater the organic matter content of the mud, the greater is the sorptive capacity for Endrin.

In another experiment, it was observed that less than 0.1 percent of the Endrin contained in the mud could be leached into the water phase at equilibrium. This indicates that once Endrin is sorbed onto river bottom mud, the potential for water pollution from this sorbed Endrin is minimal. Thus, there is little likelihood of significant water contamination resulting from the use of Endrin to crops under normal application procedures.

These findings are consistent with other data previously presented which showed that runoff from the use of soil insecticides is negligible.

It is reassuring to realize that the large silt load, 1,100,000 tons per day, carried by the Mississippi River acts as its own "clean-up" agent for chlorinated or other highly absorbable pesticides. It also predicates methods whereby local sources of potential contamination can be abated as required.

Now, gentlemen, a tolerance independent study was made, and I just received information on this matter yesterday, and I would like to read this into the record.

MR. STEIN: All right.

MR. MC ALLISTER: This letter is from the Illinois Natural History Survey, Natural Resources Building, at Urbana, Illinois, and it is signed by George C. Decker, principal scientist and head. The entire thing is, of course, a quote. It was addressed to me at the Jung Hotel.

"Dear Mr. McAllister:

"In the light of inferences made in some of the testimony presented in the hearings conducted by the Department of Agriculture, I assume perhaps the water pollution hearings that will open in New Orleans May 5 may be in part, at least, concerned "with pesticides as contaminants in drinking water obtained from the lower Mississippi River and similar situations.

"When we consider that the Food and Drug Administration, on the basis of the best toxicological data available, has deemed concentrations of aldrin, dieldrin, and related materials of 0.1 to 0.25 p.p.m. and concentrations of DDT of 7 p.p.m. as posing no threat to humans or the public health of this nation, and considering further the average food intake of man may be between 2 and 3 lb. per individual per day, and the water intake no more than 4 to 6 lb. per day, a competent scientist should find it difficult, if not impossible, to be unduly concerned over the presence of a fraction of a part per billion of one of these chemicals in drinking water. The very suggestion such a degree of water contamination might pose a threat to man should brand the speaker or writer as a propagandist, attempting to arouse sentiment for the creation of or the expansion of his pet bureaucracy.

"Since (1) in the generally accepted analytical procedures for the clean-up of extracts in the analysis of chlorinated hydrocarbon insecticide "residues it is generally recognized these residues can be pulled out of solution and collected or deposited in chromatographic columns of various types, even including ordinary soil; recognizing that the United States Public Health Service procedure for sampling and analyzing water involves the collecting of chlorinated hydrocarbon insecticide residues on activated charcoal; and (3) recognizing further the voluminous data tending to show that chlorinated hydrocarbon insecticides in soils are rather tenaciously bound to soil particles and organic matter, it would appear that considering the nature of the banks and the bottoms of our lakes, ponds, and streams and the amounts of sediment carried therein, our rivers may be self-policing insofar as pesticide residues hazardous to man are concerned.

"There seems to be considerable data that convincingly show that fish and, for that matter, most forms of aquatic life would be seriously affected if not completely destroyed by concentrations far below those that could be deemed hazardous to man, thus man would have ample warning of any impending danger to the public health.

"Despite the above comments, since those attempting to promote the cause of research on water pollution frequently assert that ordinary water purification methods will not remove or destroy pesticides and imply techniques to accomplish this purpose are unknown, we have deemed it desirable to initiate preliminary studies on the possible use of clays, peat moss, and/or other organic materials for adsorption and removal of dissolved chlorinated hydrocarbons in water. The results of this preliminary study, which has been duplicated three days apart with identical results, are shown in the attached table wherein you will note that with only 15 minutes of agitation, Wisconsin Till clay, one of the most common clays in central Illinois soils, and peat moss, a well known plant material, each removed in excess of 99% of the dissolved Endrin and Dieldrin. While these results are preliminary in nature, I submit they do indicate it should not be difficult for anyone desiring to do so to rapidly, if necessary, develop and perfect a filtration system adequate to protect the water supply of New Orleans or any other city long before the need became critical.

S. H. McAllister

"Very truly yours

/s/ George C. Decker

Principal Scientist and Head"

* * *

"Wisconsin Till Clay and Peat Moss Adsorption of Endrin and Dieldrin from Water Solutions

		Endrin ppb	Dieldrin ppb
Water solution		20.44	121.6
		% found	% found
100 ml. water agitated 15 minutes with 12 gms. Wisconsin Till Clay	Filtrate	0.98	0.22
	Residue	99.0	99.74
100 ml. water, 4 grams peat moss shaken 15 minutes	Filtrate	0.12	0.25
	Residue	99.85	99.7

Note: Filtrate and residues were separately extracted and assayed."

MR. MC ALLISTER: Now, while those figures are not numerically accurate with relation to the figures we just submitted, it is rather surprising that a group, after reading all of this testimony would initiate these types of experiments to find out where the Endrin goes, and both come up with substantially the same conclusions.

I think this is very significant, and we try it after an agricultural runoff, because you must remember that the Dieldrin is primarily a soil insecticide put in the soil, and in the case of the most of the use of Endrin in cotton, it is put on the cotton field, and if the rain comes it has to go through a soil barrier.

I think, in conclusion, it again points to the fact that the kills, and I am not denying it does not occur because I think they have occurred from time to time -- we all know that -- but I don't think that we can in any way say that these are due to normal agricultural runoffs. They are probably due to misapplication, spill or other contamination.

I thank you.

(The appendix to the statement of the Shell Chemical Company is as follows:

S. H. McAllister

Appendix to the
Statement of Shell Chemical Company

Hearings Before
U. S. Department of Health, Education, and Welfare
Four State Conference on Water Pollution
May 5, 1964
New Orleans, Louisiana

Fish Kills

According to statistices presented by the U. S. Department of Health, Education, and Welfare 1/, during the years 1960 through 1963 an estimated 10 million fish were killed in the Mississippi and Atchafalaya Rivers (see Table I). A salt water species, menhaden, accounted for about 2/3 of the total reported fish kill over 4 years, and in 1963 it accounted for most of the total reported kill.

(Table I is as follows:)

SHELL CHEMICAL COMPANY
A Division of Shell Oil Company
Agricultural Chemicals Division

New York 20, New York
May 1, 1964

TABLE I

Estimated Fish Kills In The Mississippi And Atchafalaya Rivers

	Fresh Water Fish 1/		Salt Water Fish 2/	
	No.	%	No.	%
1960	2,600,000	72	1,000,000	28
1961	75,000	28	200,000	72
1962	75,000	28	200,000	72
1963	175,000	4	5,000,000	96
Total	2,925,000		6,400,000	
% of Total	31.4		68.6	

1/ mainly catfish

2/ mainly menhaden

S. H. McAllister

Large kills of menhaden are well known along the Atlantic Coast and in the Gulf of Mexico. Dr. R. F. Nigrelli, an eminent fish pathologist associated with the New York Aquarium, has pointed out 2/ that mass mortalities of menhaden have been known since 1940 and that fish from the Gulf Coast are prone to natural mortalities of the magnitude mentioned by the USPHS. These mortalities were observed and the symptoms described long before the introduction of endrin.

There has been much discussion and speculation concerning the cause of the recent menhaden fish kill. Two descriptions of dying menhaden, written 10 years apart, bear a striking similarity and suggest reasons other than pesticides for the high menhaden kills.

The Report on the Investigation of Fish Kills in the Lower Mississippi River, Atchafalaya River, and Gulf of Mexico, written by the U. S. Public Health Service, 1964, describes the symptoms of the dying fish including menhaden as follows:

> "The symptoms of dying fish were the same as in previous years; the fish were upside down at the surface, not gasping air, had hemorrhagic areas around mouth, fins, and on internal organs, and the alimentary tract was distended with gas or

"liquids."

Westman and Nigrelli 2/ described the symptoms of menhaden in kills along the Atlantic Coast:

> "Dying fish, called 'spinners', are characterized by a loss of coordinated movements and exopthalmia of one or both eyes. Hemorrhages, caused by gas embili, were noted in the capillaries of the gills, eyes, and optic lobes of the brain."

These authors attribute the cause of these kills to water conditions as follows:

> "Analyses of the waters in which these annual mortalities occur show two conditions that might be associated with the phenomenon: (1) markedly varying salinities, and (2) organic pollution (sewage) to a degree where shellfishing is prohibited. So far we have failed to find an area where menhaden exhibit this annual mortality that does not exhibit these two conditions."

These conditions prevail in the estuarine waters of the Mississippi and Atchafalaya in late fall and winter.

The residue data furnished by the Public Health Service and the Food and Drug Administration include analyses of mud, water, and fish. However, the fish residue data are available for fresh water fish only; the menhaden, which accounted for more than 90% of the alleged fish kill in 1963, were not analyzed for pesticide residues. Therefore, it cannot be stated that menhaden fish kill can be related to the fresh water kill.

In view of the similarity of the symptoms of menhaden observed dying in completely different areas under similar environmental conditions, and in view of the lack of residue analyses of menhaden, extrapolation of data based on fresh water fish should not be made to indict Endrin as the cause of the menhaden kills. It seems particularly unreasonable further to extrapolate this proposed mechanism to earlier years when no analyses were made on either fresh or salt water fish.

In order to determine the causes of fish kills such as these, the aquatic species involved, the amounts and nature of all significant stream pollutants, the encroachment of saline waters in estuarial regions, the stream flow rate and temperature, the oxygen content and other things must be known from observations taken at fairly close intervals, particularly around and during the time of a significant fish kill.

Endrin may have caused the death of some catfish, but the very few fish analyzed from the recent kill, the sporadic nature of the kills, and the relation between fish and water residues does not (as is discussed further below) support the contention that Endrin is the specific cause. Furthermore, the extensive pollution of the Mississippi River with sewage, industrial chemicals, and other agricultural chemicals (see below) leaves so many possible explanations of the kills that much more work will be necessary before a clearcut determination can be made. To focus attention at this time on only one possibility can only be done by ignoring a score of others, for example, sewage, bacteria, viruses, inorganic and other organic chemicals, of which there are many in the river (see later section on water pollution).

Toxicity of Pesticides to Fish

Tarzwell 6,7/ has stated that chlorinated hydrocarbon concentrations found in natural waters are generally less toxic to fish than the same concentrations in the laboratory. He attributed the phenomenon to the insecticides becoming tightly bound to soils and the organic matter therein, which make it less available to aquatic life. He further has made the generalization that for a given compound the formulation also plays an important role in toxicity. Thus compounds adsorbed on carriers to make dusts are less toxic than oil sprays which, in turn, are less toxic than emulsions. In aquaria, he has shown a 2- to 3-fold safety factor for

Endrin by introducing it as a wettable powder versus a solution of technical Endrin in acetone. The latter is the normal procedure for determining fish toxicity.

Japanese workers 8/ also have demonstrated this phenomenon and have shown that at the same "apparent" dosage levels Endrin granules are less toxic than dusts which, in turn, are less toxic than emulsions. They also demonstrated that Endrin toxicity to fish is reduced with temperature reduction.

There is over a tenfold reduction in toxicity to goldfish in waters at 7° -8°C versus 17° -18°C. Increasing the temperature from 17° - 18°C to 27° -28°C results in a 10-to-20-fold increased toxicity. It is surprising that the Lower Mississippi fish kills were reported in the winter months, while no comparable kills have been reported for the peak Endrin usage period during the summer months of the year. If Endrin enters the waterways as a result of agricultural usage and could really be responsible for massive kills, then the kills should be expected in the summer.

It was found in the Taft Sanitary Engineering Center 5, 19/ that the toxic threshold level in the blood of fish is about 0.2 - 0.3 ppm. Blood levels of a similar magnitude were found in dying and dead catfish from the river, (Table 2) but it was not made clear in the Public Health

Service Report whether these samples were representative of the "massive fish kills" or were rather a limited sampling from a limited area. The latter seems to be the case, as shown by the fact that during January and February the United States Public Health Service sampled 34 catfish from the Mississippi River, which had sub-lethal amounts of Endrin in the blood, ranging from 0.04 to 0.21 ppm 5/. Also, the United States Public Health Service during early February collected nine buffalo which had no measurable amount of Endrin in the blood. Yet, Table 2 shows that two dying buffalo fish and 6 - 8 catfish collected later in February were found to contain Endrin. This situation suggests that some factor other than Endrin was responsible for the death of bullheads, buffalo, and shad. For the dying catfish, the data suggests that accidental, short-term Endrin contamination may have been responsible.

It is well known for instance that in their natural habitat fish are tolerant to Endrin concentrations which in laboratory tanks are toxic. The United States Public Health Service states 5/ that the concentration of Endrin in the blood of living fish from the Mississippi River, and the concentration of Endrin in the blood of living channel catfish exposed in the laboratory to 0.25 and 0.5 ppb Endrin for 21 days is lower, by a factor of 2 to 4, than the concentration of Endrin in the blood of dying fish (compare Tables 2 and 3).

SHELL CHEMICAL COMPANY
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New York 20, New York
May 1, 1964

TABLE 2 5/

Blood Concentration of Endrin in Dying Mississippi River Fish

Sample No.	No. Fish	No. Blood Samples	Species	ppm Endrin in Blood
2/19-3	]	[	Channel Catfish	0.41
2/20-4	] 3	[	Channel Catfish	0.40
1/31-6	]	[	Channel Catfish	0.56
2/19-4	1	1	Bullhead	0.16
2/20-3	1	1	Blue Catfish	0.26
2/20-1	1	1	Buffalo	0.14
2/19-6	1	1	Buffalo	0.12
2/19-2		Approx. 10	Shad	0.22
2/19-1		Approx. 10	Shad	0.15

TABLE 3 5/

Blood Concentration of Endrin in Channel Catfish in Laboratory Exposures

Sample No.	No. Fish	Water Concentration ppb	Exposure Time	ppm in Blood
3/13-6	1	40.0	2.4 hr., dead	1.40
2/27-5	1	40.0	2.4 hr., dead	1.98
2/27-1	1	10.0	5 hr., dead	1.20
2/27-2	1	10.0	5 hr., dead	0.70
3/9-11	1	10.0	6 hr., dead	0.95
3/9-10	1	10.0	6 hr., dead	0.86
3/9-9	1	10.0	7 hr., dead	0.89
3/5-1	1	5.0	32 hr., dead	0.31
3/4-1	1	5.0	33 hr., dead	0.46
3/19-3	1	5.0	33 hr., dead	0.50
3/4-4	1	4.0	48 hr., dead	0.36
3/3-4	1	4.0	48 hr., dead	0.26
3/4-3	1	2.5	48 hr., dead	0.27
3/3-3	1	2.5	48 hr., dead	0.31
3/3-5	1	2.5	70 hr., dead	0.34
3/5-2	1	1.6	13 days, dead	0.39
3/11-10	1	1.2	96 hr., alive	0.23
3/3-6	1	1.2	96 hr., alive	0.16
3/9-8	1	1.0	15 days, dead	0.44
3/9-12	1	0.6	96 hr., alive	0.10
3/5-3	1	0.6	96 hr., alive	0.12

TABLE 3 (Continued) 5/

Sample No.	No. Fish	Water Concentration ppb	Exposure Time	ppm in Blood
3/13-2	1	0.5	21 days, alive	0.13
3/13-3	1	0.5	21 days, alive	0.14
3/13-5	1	0.25	21 days, alive	0.10
3/13-4	1	0.25	21 days, alive	0.13
4/2-4	3	1	21 days, dead	0.24
4/2-5	1	1	9 days, dead	0.42
4/2-6	1	1	11 days, dead	0.23
3/11-7	1 Buffalo Ohio River	2.0	48 hr., dead	0.22

Within a given species, the toxicity (TLM at 96 hr.) can vary between samples taken from different locations and as measured by different workers. Ferguson 9/ has shown a 174-fold difference in endrin susceptibility in blue gills taken from the vicinity of Louisiana State College versus samples taken from the Delta Area.

However, Katz 10/ has shown intermediate toxicity values for blue gills from an Oregon pond. The same type of phenomenon on mosquito fish can be noted by comparing Katz's and Ferguson's toxicity data.

Similar differences in toxicity have been observed on the channel catfish. USPHS workers 5/ have shown that catfish in aquaria water containing 10 ppb endrin die in 7 hours or less. On the other hand, workers in Louisiana 11/ showed that all the fish were still alive in 36 hours. In the Louisiana tests, the fish were still alive after 48 hours' exposure to 5 ppb endrin, while all the fish in the USPHS tests succumbed during a 48-hour exposure to 2.5 ppb or more.

In a study by Ruber 35/ salt marshes were treated with endrin for the control of mosquito larvae. After one month, any effects of endrin on the zoo-plankton population had passed. In the same study, DDT and Baytex showed similar behavior.

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Iyatami 36/ applied endrin in three forms, emulsion dust and granule, in dosages of 100 and 200 gms per 0.245 acres. On the 28th day, the residual toxicity was very slight. The granular formulation seems to remain longer than the dust or emulsion form, however, within five weeks, all the ponds were nontoxic.

Bridges 37/ studied the disappearance of endrin from fish and other materials on a pond environment in Weld County, Colorado. This pond has received endrin from an aerial application to a nearby beet field. Application of endrin to the field was made at the rate of 6 ounces per acre. Results of this study show (1) that fish survive 40 ppb endrin in the pond water; (2) fish were observed to be dying immediately after spraying; (3) after the initial kill, no further mortality was observed; (4) analysis of the fish, mud, water, and vegetation revealed that endrin residues disappeared rapidly; after 40 days no endrin residue could be found in the water, and after 70 days no endrin was found in the mud, the vegetation, or the fish.

It is known that water concentrations of endrin below the TLm that do not cause mortality within, say, 4 weeks, are well tolerated during further exposure. 37/ This is in agreement with what has been found in mammals and with what is a generally accepted principle of pharmacology:

when tolerated dosages of a chemical or drug are given, a dynamic equilibrium sets in at a certain tolerated level and amounts eliminated equal those absorbed. It should be noted that the amount of endrin in the river water never reached the threshold limit -0.5 parts per billion.

The average Mississippi water levels of endrin in the range of hundredths or thousandths parts per billion raises a reasonable doubt whether any fish kills could ever be expected from endrin in the Mississippi River basin except from accidental, short-lived acute contamination (spills, etc.).

A hypothesis has been made in the Public Health Service Report 5/ suggesting that during starvation following a slow accumulation of endrin in the fat of the fish over many months, endrin might be released from the fat at such a rapid rate as to result in death. No evidence for this hypothesis has been presented, no fat levels in living fish have been reported, and in mammals it has been shown that such a phenomenon is not observed 20/. Furthermore no evidence of fish starvation has been presented.

The observations reported suggest that the patterns of mortality fit the condition where a high concentration of a toxic agent, which could escape the analytical sample system used, occurred in the locality for a short period of time. It would therefore, appear that minute quantities of endrin found in the water and river bottom material are coincidental and not the cause of the fish mortality. The negligible levels of endrin concentration reported in the Mississippi River waters precludes the possibility of acute poisoning from this agent since the highest concentrations of endrin reportee 5/ is even below the accepted level which could cause intoxication or death through an accumulation mechanism.

These differences noted above point clearly to the fact that we are dealing here with a highly complex problem which has no simple, straightforward answer. The lower Mississippi River and its estuarine areas constitute a region of great stress to aquatic life as a result of variations in salinity, temperature, flow rate, oxygen content, sewage, industrial chemicals and other organic pollutants. The combined efforts of federal and state agencies and the industries involved will be required to solve the problem of fish kills.

The long-term, low-level feeding experiments at Taft Center are of great importance and their results must be evaluated before further progress can be made. We also believe extensive work should be done on toxicity and habitat problems directly in the river or in simulated models of the river. We are particularly interested in the problem of individual adaption to the river environment (as well as in improvement of that environment) and plan to sponsor some university-level work in this area.

Fish Catches

The widespread usage of pesticides on lands drained by the Mississippi System has not affected the fishing industry on its various waterways. The catch has remained steady at 100,000,000 pounds ± 15% per year since 1922, the only exception being in 1931, when it dropped to 82,000,000 pounds.

If one were to accept the claims for biological magnification of pesticide residues in the food chain at its face value, one would have to consider the Gulf of Mexico a chemical catch basin. If such were the case and the case for toxicity and impairment of reproductive capacity were true, then one would expect an impairment of the fishing activity in these fisheries.

The following fish catch figures show that this is not the case 33, 34 /.

MISSISSIPPI RIVER FISHERIES CATCH

YEAR	WEIGHT IN THOUSANDS OF POUNDS
1931	82,383
1956	90,779
1960	86,482

GULF FISHERIES - FLORIDA (WEST COAST), ALABAMA MISSISSIPPI, LOUISIANA, TEXAS

THOUSANDS OF POUNDS

YEARS	TRUE FISH[a]	CRABS	SHRIMP	OYSTERS
1940	80,939	18,637	127,838	17,584
1956	660,835	16,910	193,621	13,513
		(1960-35,768)		(1960-16,098

The possible imperilling of the offshore shrimp industry by drainage of pesticide-polluted waters into the Gulf has not become a reality. The following figures excerpted from "Fishery Statistics" show the offshore shrimp catches for 1956 and 1960:

---

[a] Bluefish, croaker, black drum, red drum, flounders, groupers, king mackerel, kingfish, menhaden, mullet, sea trout, sheepshead, red snapper, spot, Spanish mackerel, etc.

	POUNDS	
PENSACOLA TO MISS. RIVER	1956	1960
0 to 5 fathoms	6,364,254	7,317,178
6 to 20 fathoms	6,406,477	5,886,653
21 to 40 fathoms	1,624,525	598,484
MISS. RIVER TO TEXAS		
0 to 5 fathoms	16,729,703	21,398,317
6 to 20 fathoms	11,689,968	9,998,925
21 to 40 fathoms	2,244,142	3,863,290
GRAND TOTAL	45,059,069	49,062,847

The Louisiana total catch figures for 1956 and 1960, which were excerpted from the U. S. Fish and Wildlife Service "Fishery Statistics for 1956" and for "1960" are as follows:

LOUISIANA FISHERIES CATCH

YEAR	POUNDS	VALUE, $
1956	7,477,400	1,291,400
1960	8,256,600	1,340,794

A detailed study of the catches for 1956 and 1960 show increases in individual fish species in question; namely, catfish, buffalo fish, carp and sheepshead. The menhaden, another species of concern in Louisiana, increased from 88,000,000 pounds in 1948 to 320,521,000 pounds in 1956, to 470,108,000 pounds in 1960.

The increases noted in the catch of individual species in total catch of fish during the year 1956 and 1960 do not lend credence to the contention that fish are being killed by endrin in normal agricultural uses because the increase in fish catch noted occurred during years of heavy uses of endrin.

Water Pollution

Of the internal waterways in the U.S.A., the Mississippi River System historically and, at the present time, is the most important. Aside from providing important shipping lanes, it has attracted many industrial operations for not only an abundant water source, but also abundant water for dilution of waste. Many of the municipalities along the waterways utilize this abundance to dilute their sewage. Some of the major pollution problems stem from the action of the disciples of the theory of "dilution solves all pollution". 22/

Along the Mississippi River itself, no major city below Minneapolis and St. Paul has proper sewage treatment plants. The Twin Cities and Baton Rouge (158,000 population) have only primary treatment systems. Cities such as New Orleans, St. Louis, Memphis, Vicksburg, and Natchez empty their raw sewage into the Mississippi. Shreveport, on the Red, and both Kansas Cities, on the Missouri, lack complete sewage treatment facilities. While sewage treatment practices for the entire system are not available to us, the practices cited exemplify the general nature of the pollution problem on the Mississippi River. The practice of dumping raw sewage into river water is of particular significance when one considers that sewage is the number 1 fish killer in the United States. 23/

In Louisiana alone 41 municipalities have no sewage treatment, and 26 have only settling tanks ahead of the stream or river connection. The Louisiana State Board of Health rated 27 communities including New Orleans as requiring new sewage treatment plants. 24/ The coliform content of water plants below New Orleans has run as high as 1,000,000/100 ml 24/. Many municipalities, such as New York City, close their public bathing beaches when the count reaches 2,400/100 ml.

Correction of these sewage inadequacies using current, practical sewage disposal technology might mitigate the pollution problem incurred by burgeoning living and working communities. Thus, a community taking water from a river, treating it, using it and re-treating it in the form of sewage, adds back to the river more than was originally present, even though much organic waste was removed. As a consequence, the communities downstream each, in turn, receive more contamination. In 1963, the USPHS reported a nationwide average total dissolved solids (TDS) from secondary sewage effluent plants of 734 ppm with a range from 350 to 1,362 25/. Water supplies containing 500 ppm TDS are considered unfit 26/, and the hazard to fish varies with the detailed chemical composition of the TDS. High levels of TDS would be expected to increase the stress on aquatic life and increase susceptibility to other toxicants.

In addition to being the prime cause of pollution-caused fish kills, raw sewage in water supplies, even though treated, have lead to outbreaks of such viral diseases as infectious hepatitis and poliomyelitis as well as numerous bacterial-caused ailments 26/.

On more than one occasion, attempts have been made to link pesticides with epidemics. In New Jersey during 1962, pesticides were suspected of causing an epidemic of hepatitis until it was found that the hepatitis resulted from consuming clams harvested from waters polluted with raw sewage.

Since industrial wastes comprise the nation's number 2 fish killer 23/, it is useful to consider the total industrial waste load on the Mississippi Basin. Of 95,617 manufacturing establishments in 18 of the states served by the waterway, 39,970 including 118 pesticide plants are possible sources of wastes which might contribute to pollution.

Industrial wastes introduce a great potpourri of pollutants, viz., natural and synthetic organic compounds and inorganic compounds. Relatively few of these are routinely determined nor can most be readily detected.

Some organic compounds such as phenols, though not routinely analyzed, are often found in the waterway. Low molecular weight phenols exhibit toxicity to fish (and other invertebrates) approximating that of pesticides. Some typical data are as follows:

Material	24-Hour LD50 (ppm) at 15°C Rainbow Trout Embryos
phenol	5.0
o-cresol	2.3
m-cresol	6.5
p-cresol	4.0
1,2,4-xylenol	4.0
1,3,4-xylenol	27.7
1,3,5-xylenol	50.0
1,4,5-xylenol	2.0

Mining operations constitute the number 3 source of U. S. fish kills 23/. Of the 10 leading mining states in the U. S., 9 lie wholly or partly in the Mississippi Basin 29/. They are Ohio, Kansas, Kentucky, Oklahoma, Louisiana, Illinois, West Virginia, Pennsylvania, and Virginia who are attempting to seal off abandoned coal mines whose acid drainage seriously impairs the water quality and kills many fish along miles of the Ohio River and its tributaries.

In addition to the historical pollution burden of shipping activities, in recent years the rapid growth of outboard motor usage has contributed further.

In 1959, the motors consumed 336,000,000 gallons of gasoline and 22,000,000 gallons of lubricating oil. The acute toxicity of OME (outboard motor exhaust in water) has been determined for several fish species. Based on these values, it can be demonstrated that sufficient boating activity in confined bodies of water can cause extremely critical situations with respect to fish survival. These situations are obtained when the following concentrations of pollutants are built up: 30/

Pollutant	Concentration, PPM
Oil, non-volatile	1.7
Oil, volatile	0.94
Lead	0.0087
Phenols	0.01
Chemical Oxygen Demand	7.1

In addition, intermittent discharges from ocean vessels traveling up the Mississippi as far north as Baton Rouge are a frequent cause of water impairment, and, no doubt, fish kills.

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Pesticide Residues in the Aquatic Environment

While the total pollution burden on the Mississippi River system is large, there are no toxicologically significant residues of dieldrin or endrin in the waters of the system nor in the waters of the four-state area (Arkansas, Mississippi, Louisiana, and Tennessee). This is clear from the data on water residues shown in Table 4, which agree in general with those reported by the USPHS. 5/ All water residue levels shown are in the hundredths to thousandths parts per billion range or less and the quantitative validity of such data is ambiguous at present.

Using presently known techniques of sample preparation, clean-up and gas-liquid chromatographic analysis, residue levels in the parts per million range can be determined with reasonably good accuracy; values in the parts per billion range are not reliable unless several determinations are made, and values in the parts per trillion range are only qualitative. For example, merely carrying samples past a field that has been freshly treated with a pesticide can cause contamination in this range. Furthermore, in a routine gas-chromatographic analysis it is possible to mistake other compounds for dieldrin or endrin. For example, 2,4,D esters, members of the DDT complex, toxaphene, Thiodan and natural products among others, will appear falsely as dieldrin or endrin on some GLC columns. Even though much of the extraction-cleanup procedure is directed toward isolating aldrin, dieldrin and endrin for quantitation, many unidentified peaks appear on the gas-chromatographic tracings, the number varying with the detection unit. In our own water work, we have found 2 to 8 unidentifiable compounds with electron affinity.

Under methods which appear to be in use at the Taft USPHS Center, many pesticides which are likely to be used in the Mississippi Basin are not extracted or if extracted will be eliminated in the clean-up procedure and will thus appear to be absent.

Even though the levels of the water residues of Table 4 are insignificant from the standpoint of human health or aquatic life, there remains the question of how real they are and, if real, what is their source? At this time in the development and use of the analytical techniques involved, we can only say that little confidence can be placed in the quantitative meaning of residue concentrations in the range of those shown in Table 4. Therefore, more work must be done on the method and more data accumulated which bear a cause and effect relationship between all important pollution levels in the river and fish kills.

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The highest endrin levels in the Mississippi were reported by the USPHS for their early October, 1963 sample at Memphis and for their mid-October sample at New Orleans. If these values are real, it is curious that no associated fish kills were reported. Since temperature plays such an important role in toxicity (the higher the temperature the higher the toxicity), fish should have been more susceptible in September and October than during the winter months.

Residue data in fish samples taken by Shell and data reported by the USPHS on dead or dying fish are shown in Table 5. The Shell samples represent living fish, but even in view of that, the discrepancy is large and suggests that the samples analyzed by the USPHS must have resulted from a wave of endrin which moved through the river following some accidental or unusual discharge. All of the Shell samples showed residue levels which are harmless to these fish.

(Tables 4 and 5 are as follows:)

SHELL CHEMICAL COMPANY
A Division of Shell Oil Company
Agricultural Chemicals Division

New York 20, New York
May 1, 1964

TABLE 4

WATER ANALYSES FROM MISSISSIPPI RIVER DRAINAGE SYSTEM

Waterway and Location	Concentration (Parts Per Billion) (Median or Range of Positive Samples)				Reference
	DDT Complex*	Aldrin	Dieldrin	Endrin	
Missouri River - Omaha, Neb.					
Raw Water	0.097	<0.001	0.007	0.006	1
Tap Water	0.053	<0.001	0.003	0.005	1
Missouri River - Plattsmouth, Neb.					
Raw Water	0.040	<0.001	0.004	<0.002	1
Tap Water	0.034	<0.001	0.004	0.004	1
Des Moines River - Ottumwa, Iowa					
Raw Water	0.154	<0.001	0.009	<0.001	1
Tap Water	0.067	<0.001	0.005	<0.001	1
Kansas City, Kansas					
Tap Water	0.092	<0.001	0.007	0.003	1
Missouri River - South of Kansas City, Missouri					
Raw Water	0.238	0.025	0.017	0.008	1
Ohio River - Cairo, Illinois					
Raw Water	0.042	<0.001	0.015	0.005	1
Cotton field run-off near Cairo,Ill.	0.219	<0.001	0.021	0.012	1
Mississippi River - Osceola, Ark.					
Raw Water	0.129	<0.001	0.014	0.006	1
Yazoo River - Greenwood, Miss					
Raw Water	0.116	0.006	0.013	<0.001	1

TABLE 4 (continued)

Waterway and Location	Concentration (Parts Per Billion) (Median or Range of Positive Samples)				
	DDT Complex*	Aldrin	Dieldrin	Endrin	Reference
Sunflower River - Anguilla, Miss. Raw Water	0.383	<0.010	0.021	0.035	1
Yazoo River - Yazoo City, Miss.					
Raw Water - Top	0.146	0.006	0.011	0.015	1
Raw Water - Bottom	1.636	<0.010	0.053	0.028	1
Bayou Teche - Franklin, Louisiana Finished Water	0.005 (1/18)***	-	0.004 (4/18)***	0.011 (2/18)***	2**
Bayou Teche - Franklin, Louisiana Raw Water (Holding Reservoir)	0.016 (1/21)***	-	0.010 (1/21)***	0.003 (5/21)***	2**
Bayou Teche - Franklin, Louisiana Raw Water (Pump House)	0.024 (1/22)***	-	0.020 (1/22)***	0.007 (7/22)***	2**
Bayou Yokely - Franklin, Louisiana Raw Water	-	-	0.427 (4/18)***	0.101 (6/18)***	2**
Little Bayou Black - Houma, Louisiana Finished Water	-	-	-	<0.001-0.004 (8/14)***	2**
Little Bayou Black - Houma, Louisiana Raw Water	-	-	-	<0.001-0.004 (4/13)***	2**
Mississippi River - Lock & Dam No. 3 below St. Paul, Minnesota	-	-	<0.001	<0.001	3****

TABLE 4 (continued)

Waterway and Location	Concentration (Parts Per Billion) (Median or Range of Positive Samples) DDT Complex*	Aldrin	Dieldrin	Endrin	Reference
Mississippi River - Dubuque, Iowa		-	0.067 <0.001 <0.001	<0.001	3****
Mississippi River - Burlington, Iowa		-	0.001 <0.001 0.001	<0.001	3****
Mississippi River - E. St. Louis, Ill.		-	0.003 0.003 0.001	<0.001	3****
Mississippi River - Cape Girardeau, Mo.		-	0.005 0.003 0.001	0.007 <0.001 <0.001	3****
Mississippi River - West Memphis, Ark.		-	0.002 0.015 0.058	0.019 0.026 0.214	3****
Mississippi River - Delta, Louisiana		-	0.022	0.022	3****
Mississippi River - Vicksburg, Miss.		-	0.005 0.004 0.003	0.020 0.020 <0.001	3****
Mississippi River - New Orleans, La.		-	0.013 0.032 0.024 0.007 0.011 0.034	0.074 0.082 0.083 0.060 0.134 0.054	3****

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* DDT complex includes o-p DDT, p-p' DDT and DDE

** BHC found in many samples.

*** First number in parenthesis indicates number of positive samples, second number indicates total number of samples analyzed. Data taken from "Pesticide Pollution Studies-Progress Report", USDHEW, PHS, March 1963.

**** Other unidentified halogenated compounds were indicated.

SHELL CHEMICAL COMPANY
A Division of Shell Oil Company
Agricultural Chemicals Division

New York 20, New York
May 1, 1964

Table 5

Insecticide Residues in Fish *

		Parts Per Million						
	Fish	p,p'-DDT	o,p-DDT	DDE	Aldrin	Dieldrin	Endrin	Reference
	Yellow Cat							
North of Omaha, Nebraska (Missouri River)	Viscera	0.61	<0.05	0.17	<0.01	<0.01	<0.01	1
	Liver	0.22	<0.05	0.08	<0.01	0.12	<0.01	
	Meat	0.15	<0.05	0.07	<0.01	0.02	<0.01	
	Channel Cat-1							
	Viscera	3.8	0.48	0.54	0.1	0.9	-	1
	Liver	0.96	<0.01	0.09	<0.02	0.15	0.01	
	Meat	0.64	<0.05	0.07	0.16	0.17	0.01	
	Channel Cat-2							
	Viscera	1.8	<0.05	0.48	<0.01	0.42	0.05	1
	Liver	<0.1	<0.05	<0.02	<0.01	<0.02	<0.01	
	Meat	0.4	<0.05	1.0	<0.01	0.08	0.01	
	Carp							
	Viscera	2.5	<0.1	0.40	0.02	0.30	<0.02	1
	Liver	1.4	0.28	0.19	<0.01	0.14	<0.02	
	Meat	0.43	<0.05	0.09	<0.01	0.06	<0.02	
Louisiana, Missouri (Mississippi River)	Carp-1							
	Viscera	<0.1	<0.05	0.02	<0.01	<0.02	<0.01	1
	Liver	0.16	<0.05	0.03	<0.01	<0.02	-	
	Meat	0.2	<0.05	0.04	<0.01	0.03	<0.01	

Table 5 (continued)

Insecticide Residues in Fish *

	Fish	Parts Per Million						Reference
		p,p'-DDT	o,p-DDT	DDE	Aldrin	Dieldrin	Endrin	
Louisiana, Missouri (Mississippi River) (Continued)	Carp-2							
	Viscera	0.1	<0.05	0.02	<0.01	<0.02	<0.01	1
	Liver	0.14	<0.05	0.02	<0.01	<0.02	-	
	Meat	0.13	<0.05	0.03	<0.01	0.02	<0.01	
	Carp-3							
	Viscera	<0.1	<0.05	<0.02	<0.01	<0.02	<0.01	1
	Liver	<0.1	<0.05	<0.02	<0.01	<0.02	-	
	Meat	0.1	<0.05	<0.02	<0.01	<0.03	<0.01	
	Blue Cat-4							
Yalobusha River (2-½ mi. North of Greenwood, Miss.)	Viscera	5.5	0.8	1.5	<0.02	0.02	0.27	1
	Liver	1.5	0.21	0.32	<0.01	0.02	0.03	
	Meat	2.2	0.16	0.67	<0.01	<0.02	0.07	
U.S.P.H.S. (Mississippi River)	Fish (dead & dying)							
	Muscle						0.5-1.0	
	Liver						1.0-2.0	
	Fat & Eggs						6.0	

* - Samples taken and analyzed by Shell, April 1964.

Mud residue data on Shell samples are shown in Table 6. These data, as are those above, are from an ongoing study and we shall report additional data as they are acquired at a later date. The mud residues are quite low, although they are much higher than those shown in Table 4 for water. We would expect any aldrin, dieldrin, or endrin residues in the river to be associated with the mud since these compounds are tightly bound to solids and other suspended particulate matter. This situation should be more pronounced in the Mississippi River because of its high load of organic matter.

Whether these mud residues are harmful to fish is uncertain but unlikely. We have a short-term study of this point in progress and our initial results indicate that endrin is not removed from Mississippi mud by water extraction. Fish placed in contact with samples of this mud sufficient in size to contain lethal amounts of endrin were not harmed.

In considering the importance of any single compound to the total pollution burden, one must know the composition of the remaining burden. If we disregard the total pollution as measured by radioactivity determinations, unusual plankton populations, B.O.D. and C.O.D. (biological and chemical oxygen demand), coliform counts, turbidity, and total dissolved solids, and confine ourselves merely to that portion of the pollution burden expressed as carbon-chloroform-alcohol extractables, the endrin and dieldrin share of the burden is inconsequential. The tabulation below illustrates this point:

Sampling Station	Typical Total Extractables 32/	Average Endrin ppb 5/	Average Dieldrin 5/	Share of Burden %w	
				Endrin	Dieldrin
New Orleans	78	0.080	0.020	0.1	0.04
Vicksburg	66	0.007	0.004	0.01	0.006
West Memphis	122	0.080	0.025	0.07	0.02
Cape Girardeau	294	0.003	0.003	0.001	0.003

(Table 6 is as follows:)

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Agricultural Chemicals Division

New York 20, New York
May 1, 1964

TABLE 6

Insecticide Residues in Mud

		Parts Per Million						
		p,p'DDT	o,p-DDT	DDE	Aldrin	Dieldrin	Endrin	Reference
North of Ft. Dodge, Iowa at Hy. 169 (Des Moines River)	Mud	0.0034	<0.001	<0.0004	<0.0002	<0.0004	<0.0003	1
Omaha, Nebraska (Missouri River)								
E. Side Mormon Bridge	Mud	0.0048	<0.001	0.0006	0.0017	0.001	<0.0003	1
W. Side Mormon Bridge	Mud	<0.003	<0.001	<0.0004	<0.0002	<0.0004	<0.0003	1
North of Kansas City, Missouri (Missouri River)	Mud	0.0074	0.001	<0.0004	0.0048	<0.0008	<0.0003	1
South of Kansas City, Missouri (Missouri River)	Mud	0.0052	0.001	<0.0004	0.0086	0.0022	<0.0003	1
Plattsmouth, Neb. (Missouri River)								
E. Side	Mud	<0.003	<0.0001	<0.0004	<0.0002	<0.0004	<0.0003	1
W. Side	Mud	<0.003	<0.0001	<0.0004	<0.0002	<0.0004	<0.0003	1
Greenwood, Miss. (Yazoo River)	Mud	0.042	0.0096	0.003	0.0004	0.0009	0.0006	1
Anguilla, Miss. (Sunflower River)	Mud	0.0096	<0.0001	0.0008	<0.0002	0.0005	0.0004	1
Yazoo City, Miss. (Yazoo River)	Mud	0.094	0.013	0.0041	<0.0002	0.0014	0.0008	1

S. H. McAllister

Summary of General Toxicology and Pharmacology of Aldrin, Dieldrin, and Endrin as Related to Human Health

When tolerances for aldrin, dieldrin, and endrin were established in 1955, long-term toxicity studies had been completed and were considered adequate for the purpose of establishing safe levels on various raw commodities. Tolerances of 0.25 ppm were established for aldrin and dieldrin on a number of raw commodities. Based on the residue data presented for endrin, however, it was decided that a tolerance higher than zero was not needed. At the time, the limit of sensitivity of the best methods of analysis for endrin was 0.1 ppm. Therefore, it was generally recognized that any endrin residues on raw commodities which approached 0.1 ppm would not constitute a hazard to the public health.

Since the classical toxicological studies were completed, extensive investigations into the fate and the metabolic pathway of these compounds in the animal body has continued. The results have shown (1) that even though these compounds store in the fatty tissues, they reach an equilibrium in the fat for any given level of intake, (2) endrin stores in the fat to a considerably lesser extent than other similar compounds such as dieldrin and DDT, (3) they gradually metabolize in the body to less-toxic compounds which are excreted, (4) the half-life of each in the fatty tissues of mammals has been determined, and (5) their presence in the body can be monitored by blood and fat analyses which utilize the highly sensitive methods now available.

Aldrin, dieldrin, and endrin, like other chlorinated hydrocarbon insecticides, can be absorbed into the mammalian body by ingestion, inhalation, or through the intact skin. If the amount absorbed is sufficiently large, symptoms of intoxication result. These are similar to those produced by other chlorinated hydrocarbon insecticides arising from stimulation of the central nervous system.

Where neurological effects have been observed from gross overexposure of workers during manufacture and formulation, recovery has been rapid and complete in all cases, usually in less than 6 months. Thus, all evidence accumulated over the last 12 years indicates that permanent neurological anomalies do not occur as a result of intoxication by aldrin, dieldrin, or endrin. Analyses of blood samples indicates that the average concentration of these compounds in the system of occupationally exposed persons ranges from 5 to 30 times the level present in the general population. These industrial workers have been under continuous and exhaustive medical supervision for 12 years and no evidence of impaired health has been found according to their own subjective evaluation, their absenteeism and work records, and all available clinical and laboratory tests 13, 14/. More extensive studies are now in progress at Shell's Denver plant under an NIH grant to the University of Colorado Medical School.

Analyses of total diet samples have demonstrated that present tolerances provide adequate protection against the contamination of human foodstuffs well within the levels considered to be safe 17/. The fact that the uses of these compounds were probably at their peaks during the years these diet samples were analyzed for residues is conclusive evidence that no hazard to the public health exists and is not likely to occur now or in the future as a result of residues of these materials in the human diet. Hayes of the U. S. Public Health Service has already testified that there is no evidence of any disease whatsoever resulting from exposure of humans in any way to these compounds 12/.

Since mid-1963, an Advisory Panel selected by the Food and Drug Administration from a list of qualified scientists compiled by the National Academy of Sciences has been reviewing the data and information available on aldrin and dieldrin. The purpose of this study is to determine if the uses and tolerances established for these compounds should be revised. Until this panel completes its study, any change in the labeling or tolerances would be premature and unjustified.

Hazards to Humans of Mississippi River Water Containing Traces of Aldrin, Dieldrin or Endrin

An important question concerns the extent of the hazard to humans, if any, from drinking water containing trace amounts of aldrin, dieldrin or endrin. According to data published by the U. S. Public Health Service, the average concentration of dieldrin in the lower Mississippi River during the period July-October 1963 was about 0.02 ppb; the aldrin concentration was below the level of detection and the average concentration of endrin was 0.08 ppb 5/. During this period, the endrin content of treated water at New Orleans ranged from 0.006 to 0.160 ppb. If it is assumed that these levels represent the extremes, then the average endrin content of the potable water would be 0.08 ppb during this period. However, a sample of treated water taken on March 5, 1964, showed only 0.025 ppb endrin and less than 0.007 ppb dieldrin 5/.

The Food and Drug Administration normally uses a safety factor of 100 in arriving at the maximum tolerance that can be established for a pesticide chemical residue on a food commodity. The maximum tolerances set on food commodities for aldrin and dieldrin are 0.25 ppm. In the case of endrin, a tolerance above zero was never set because no need for a higher tolerance was ever indicated. However, toxicological data indicate that 1 pppm is the so-called "no effect" level for endrin. In the case of the Mississippi River water, the safety factor for endrin during the period July-October 1963 is more than 12,000. Based on the amount of endrin found in the treated water on March 5, 1964, (0.025 ppb), the safety factor would increase to 49,000. When this sample was taken, the water flow rate was only 300,000 cfs 15/. A month later, the flow was up to 900,000 cfs. As a result of dilution, the margin of safety was probably tripled. The safety factor of dieldrin is even greater. In fact, the additional safety factor for dieldrin in the Mississippi over and above the established tolerance (0.25 ppm) was greater than 12,000 during the period July-October 1963 and increased even more during March and April 1964.

These data confirm the opinion expressed by Mr. Larrick, Commissioner of Food and Drugs (USDHEW), that the levels of endrin found in treated Mississippi River water are pharmacologically insignificant 16/.

It can only be concluded that these compounds contribute only an insignificant trace to the total burden of contaminants in the Mississippi River and constitute no hazard to the public health.

Hazard to Humans of Mississippi River Fish Containing Aldrin, Dieldrin, or Endrin Residues

Let us assume that the edible flesh of catfish from the Mississippi River contains an average of 0.2 ppm endrin and the "standard man" in the lower Mississippi area eats one-half pound of these catfish in one day, three days each week, throughout the year. On this basis, his total solid diet would contain an average of 0.01 ppm endrin. (Data reported by the FDA show that fish from the Mississippi River showed endrin residues ranging from 0 to 0.26 ppm and dieldrin residues ranging from 0 to 0.18 ppm 16/.)

On the basis of the "storage factor concept," the maximum amount of endrin that would be expected to store in the fat of humans consuming these catfish can be estimated from the following formula which is based on experimental data and observations, much of which is published information:

$$\text{Maximum storage factor for endrin} = \frac{\text{ppm endrin in fat}}{\text{ppm endrin in diet}} = 7.$$

By applying this empirical formula, the endrin content of the fat of humans eating the above weekly diet of catfish should be 0.07 ppm.

However, analyses of human fat samples obtained in the Louisiana area show no detectable (less than 0.01 ppm) endrin 18/. Furthermore, human fat samples taken from 3 other areas in the U. S. (California, New York, and Ohio) also show no detectable endrin present (less than 0.01 ppm) 18/. These findings vividly point up the conclusion that no significant amount of endrin is present in the diet of humans in the Louisiana area, or, for that matter, in the U. S. The lack of endrin in the diet was previously observed by Dr. Fishback in his published analyses of total diet samples taken during 1962 and 1963 from various U. S. cities 17/. In his studies he found that no endrin was detected in the samples analyzed. This means if any was present at all, it was at a level of less than 0.002 ppm.

On the basis of these findings it must be concluded that the endrin content of catfish in the Mississippi River is not contributing more than an insignificant trace, if any, to the present pesticide residue burden in the total diet, and, thus, it presents no hazard to the public health. Furthermore, endrin apparently is not contributing any detectable amount of pesticide residue to the present body burden of chlorinated hydrocarbon insecticides.

Since dieldrin is present in catfish at considerably lower levels than endrin, and since it is less toxic than endrin, it can be discounted entirely as any hazard to the public health. Since aldrin converts to dieldrin in the animal body, none would be expected to be present in fish and none has been found. Therefore, aldrin, per se, can be disregarded.

Toxicity of Fish Viscera to Mice

In the Public Health Service Report 5/, experiments were mentioned in which viscera of catfish presumably from the Mississippi River "were extracted with acetone and dissolved in vegetable oil." Mice then received intraperitoneal (i.p.) injections of 0.5 ml or 0.3 ml of the oil extract. These quantities represent approximately 1 gram of a vixceral tissue. Both these injections were reported to be fatal to the mice.

In the same report, the maximum level of endrin found in the visceral organs of dying catfish did not appear to exceed 6 ppm. In fact, based on the endrin content of liver which was 1 to 2 ppm, and fat and eggs which were 6 ppm, it would appear that the endrin content of the viscera of the dying catfish was well below 6 ppm.

In any case, if it is assumed that the viscera contained the maximum amount of endrin, 6 ppm, then 1 gram of the viscera would contain 6 micrograms of endrin. On this basis, the doses that the mice received would have been in the range of 0.1 to 0.2 mg/kg. A review of the toxicity data for endrin indicates that these dosages intraperitoneally would not be expected to kill mice. Data obtained by Lade 2/ show that the i.p. LD_{50} for formulated endrin for rats is 4 mg/kg; the oral LD_{50} for the same material is 5 mg/kg. Since the acute doses of endrin for mice correspond closely to those for rats, the possibility is extremely remote that one-twentieth or less of the i.p. LD_{50} dosage to rats would be lethal to mice.

Therefore, in view of this apparent conflicting evidence, it appears that some toxic agent other than endrin may be responsible for, or at least contributing to, poisoning of the mice. Without the availability or appropriate controls, it cannot justifiably be concluded that the death of the mice was due to endrin. In this regard, it must be recognized that the use of acetone as an extraction solvent for the viscera would extract practically every organic pesticide in common use, as well as a number of other toxic materials. Many of these compounds could be present in the injected solution and either alone, or in combination with other toxicants and/or chemicals, could well be lethal to mice.

In other words, the death of mice resulting from an injection of the viscera extracts is not proof, or even a reliable indication, that death was due to endrin.

Additional Information on Pesticides in the Mississippi River Basin

The total pollution burden on the Mississippi River System is high. Organic chemicals represent only a small portion of the total and pesticidal chemicals represent a much smaller portion. Of the pesticides used in the Mississippi Basin aldrin, dieldrin, and endrin represent only a small fraction (less than 2%) of the total.

Most of the other materials are toxic to fish or other organisms in the aquatic environment. However, hazard can only be determined by considering the total tonnage used and the concentration in the water along with the toxicity. Some of the other pesticides used in the Mississippi Basin, their fish toxicity, and tonnage used is given in Table 7.

With the possible exception of DDT, none of these compounds have been sought in the river environment. Furthermore, many of them are excluded or destroyed in the extraction and clean-up steps of the analytical method now in use. Methods for detecting many others are not available.

If, in fact, the fish kills are caused by pollution, it seems unreasonable to single out endrin, as the sole cause. Much more analytical investigation is indicated to determine the levels of all river contaminants including pesticides.

(Table 7 is as follows:)

SHELL CHEMICAL COMPANY
A Division of Shell Oil Company
Agricultural Chemicals Division

New York 20, New York
May 1, 1964

TABLE 7

TOXICITY TO FISH AND ESTIMATED USAGE OF SOME PESTICIDES COMMONLY USED IN THE MISSISSIPPI RIVER DRAINAGE BASIN

Species	Exposure Time	Name of Compound [13]	TLm [1] (ppm)	Ref.
Bluegills	96 hr.	Chlorinated Camphene [2]	0.0035	A,B,C
		BHC [3]	0.790	A,B,C,D
		0,0-Dimethyl S-4-Oxo-1,2,3-benzotriazin-3(4H)-yl-methyl phosphorodithioate [4]	0.0052	B,F,G
		DDT [5]	0.016	A,B,C,D
		Phorate	0.0055	B
		Parathion	0.099	B,F
		1-Naphthyl-N-Methyl Carbamate [6]	5.6	A,C
		Malathion	0.090	B
		Endosulfan	0.0035	B
		2,4-D, alkanolamine [7]	4.0	Q
	48 hr.	Silvex	0.6	H
	4 wks.	Diuron [8]	1.2	Q
	24 hr.	2,4-D (propylene glycol butyl ether ester) [9]	1.2	H
		2,4,5-T	15.0	Q
		Chlorine (water treatment)	0.025-0.04	Q

TABLE 7 (continued)

Species	Exposure Time	Name of Compound	TLm (ppm)	Ref.
Fathead minnows	96 hr.	Chlorinated Camphene (Toxaphene,etc.)	0.0051	B
		BHC	2.3	A,B,C,D
		O,O-Dimethyl S-4-Oxo-1,2,3-benzotriazin-3(4H)-yl--methyl phosphorodithioate	0.093	B,F,G
		Phorate	0.24	B
		Parathion	1.3	B,F
		Zineb	0.008	B
		Rotenone	0.006	B
		Ziram	0.008	Q
		Endosulfan	0.0018	B
		1-Naphthyl-N-Methyl Carbamate	13	A
		Malathion	16	B
Rainbow Trout	96 hr.	Chlorinated Camphene (Toxaphene,etc.)	0.0084	B,C,I
		1-Naphthyl-N-Methyl Carbamate	1.35	B,C,I
		O,O-Dimethyl S-4-Oxo-1,2,3-benzotriazin-3(4H)-yl--methyl phosphorodithioate	0.003	B,G
		DDT	0.042	B,C,I
	48 hr.	2,3,6-Trichlorophenylacetic acid 10/	7.5	J

TABLE 7 (continued)

Species	Exposure Time	Name of Compound	TLm (ppm)	Ref.
Rainbow Trout(cont'd)	24 hr.	2-chloro-4,6-bis-(ethylamino)-S-Triazine 11/	0.095	K
		2,4,5-T	0.12	K
Stickleback	96 hr.	Chlorinated Camphene (Toxaphene, etc.)	0.0086	B,C,J
		1,-Naphthyl-N-Methyl Carbamate	3.990	B,C,J
		0,0-Dimethyl S-4-Oxo-1,2,3 -benzotriazin-3(4H)-yl--methyl phosphorodithioate	0.012	B,G
		DDT	0.018	B
		Malathion	0.094	B
Goldfish	96 hr.	Chlorinated Camphene (Toxaphene, etc.)	0.056	B,C
		BHC	2.3	A,B,C,D
		0,0-Dimethyl S-4-Oxo-1,2,3 -benzotriazin-3(4H)-yl--methyl phosphorodithioate	1.4	B,G
		DDT	0.027	A,B,C,D
		Parathion	2.7	B,L
		Malathion	0.45	B
Guppies	96 hr.	Chlorinated Camphene (Toxaphene, etc.)	0.020	A,B,C
		BHC	2.17	A,B,C,D
		0,0-Dimethyl S-4-Oxo-1,2,3 -benzotriazin-3(4H)-yl--methyl phosphorodithioate	0.12	B,G

TABLE 7 (continued)

Species	Exposure Time	Name of Compound	TLm (ppm)	Ref.
Guppies (cont'd)	96 hr.	DDT	0.043	A,B,C,D
		Parathion	0.056	B
		Malathion	0.84	K
		MCPA	30-40	K
Coho Salmon	96 hr.	Dalapon	340	Q
		Chlorinated Camphene (Toxaphene, etc.)	0.0094	B,C,I
		1-Naphthyl-N-Methyl Carbamate	0.997	B,C,I
		O,O-Dimethyl S -4-Oxo-1,2,3-benzotriazin-3(4H)-yl-methyl phosphorodithioate	0.004	B,G
		DDT	0.044	B,C
		Diuron	33	Q
Brown Shrimp	24 hr.	BHC	0.4	C
	48 hr.	1-Naphthyl-N-Methyl Carbamate	0.0025	P
	96 hr.	DDT	0.0175	C,N
Blue Crab	48 hr.	DDT	0.01	P
		Heptachlor	0.063	P
		Chlordane	0.48	P
		Methoxychlor	0.55	P

TABLE 7 (continued)

Species	Exposure Time	Name of Compound	TLm (ppm)	Ref.
Blue Crab (cont'd)	48 hr.	Endosulfan	0.035	P
		Chlorinated Camphenes	0.33	P
		1-Naphthyl-N-Methyl Carbamate	0.55	P
Shiner	96 hr.	3-(p-chlorophenyl)-1,1-dimethyl urea	41	O
		Dalapon	390	O
		Amino Triazole 12/	1370	O
Sunfish	-	2,4-D Acid	1000	K

1/ TLm = Median Tolerance Limit, the concentration of the material which half of the test organisms can tolerate in the stated time interval.
2/ Estimated Usage - 12.4 Million lbs/yr, Arkansas, Louisiana, Mississippi - on cotton
3/ Estimated Usage - 1.3 Million lbs/yr, in Drainage Basin - on cotton
4/ No figures available; estimated 6.3% of 1962 cotton acreage treated.
5/ Estimated Usage - 19.45 Million lb/yr, in Drainage Basin-on corn and cotton
6/ Estimated Usage - 1.6 Million lb/yr, in Drainage Basin - on cotton
7/ Estimated Usage - 36,800 lb/yr, Lower Mississippi River.
8/ Estimated Usage - 2.8 Million lb/yr, in Drainage Basin - on cotton
9/ Estimated Usage - 58,000 lb/yr, TVA controlled area.
10/ Estimated Usage - 608,880 lb/yr, Drainage Basin
11/ Estimated Usage - 3.3 Million lb/yr, Drainage Basin
12/ Estimated Usage - 3.5 Million lb/yr, Drainage Basin
13/ Other compounds of unknown toxicity are in wide tonnage use such as the herbicide, 3',4'-dichloropropionanilide on rice, at approximately 2 million lb/yr in the Drainage Basin.

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MR. STEIN: Thank you, Mr. McAllister.

Before Mr. Trygg asks a question, in your first statement, the next to the last sentence says:

> "In the meantime, all parties concerned should try to avoid inflammatory and unjustified statements."

I call your attention to the last statement of Mr. Decker's letter you introduced:

> "While these results are preliminary in nature, I submit they do indicate it should not be difficult for anyone desiring to do so to rapidly, if necessary, develop and perfect a filtration system adequate to protect the water supply of New Orleans or any other city long before the need became critical."

What do you think of that, Mr. Trygg?

MR. TRYGG: I think that your own testimony was fine and parallels pretty much what I am going to say this afternoon, but I think this last testimony is pretty bad.

This man apparently has never been south of the Mason-Dixon Line.

I am an Iowan, a graduate of the University of Iowa, Sanitary Engineering option, and I am a graduate of the University of Michigan.

I would submit that the water plants in Louisiana and the New Orleans water plant are as good or better than anything in Illinois.

I don't know who this man is, or how he represents himself, but I would say that this inference that we don't have the ability to develop methods of treatment and the very thought that we wouldn't be thinking about this, seems pretty much out of order.

My feeling is that you could have well left his testimony off the record and stopped where you had, to begin with, and then we wouldn't have some of these unpleasant things.

I am sure this man has never been in a position to have to answer thousands of telephone calls as to whether his water supply is safe. I feel almost positive he never has been in that position, and to me this kind of testimony is the kind of thing that will throw the whole meeting into an uproar, because I won't stand by and have that kind of stuff go into the record without my comment.

MR. MC ALLISTER: I just want to make a point. I put it on the record exactly as it was written to me.

MR. STEIN: Would you talk into the microphone, please?

MR. MC ALLISTER: I put this statement on the record exactly as I received it, because I didn't want to feel that I had expurgated it or deleted it in any respect, and I think that that is the proper thing to do.

I would say that if this is considered, as you do, an inflammatory or unjustified statement, then what I said before goes for it too, I guess; but I don't think he meant it that way, and perhaps in my rapid reading of it and knowing the man personally, and I think many of the agricultural scientists do, I would say that what he intended to say was that we now know that in order to get Endrin out of the effluent waste of a plant, or something like that, that the clay has very strong absorptive properties, as with charcoal. I think that we have to realize that in the test experiments that were made up in the State of Washington, where unusual precautions were taken to prevent contamination of streams in that forest treatment, where several pesticides were used, they had a very effective way of preventing the insecticide -- the primary one was DDT -- from contaminating oysters, by having it run through a filter consisting of charcoal.

I also want to point out that I think the gentleman who wrote this is extremely well known and is a very fine agricultural scientist. I have the highest respect for him.

I would say this: That I think if you read this letter in the light that it was said to me, that one should not take any offense at it. As a matter of fact, I don't think there is any real implication that can be derived about the sewer systems at all.

I think the letter, taken in its proper context, is clearly directed towards Endrin or hydrocarbon chlorinated pesticides in the water. I am sure that that is what he intended.

Again, if I can try and be calm about it, I think we shouldn't for one moment think that he was impugning either the questions of what you can do about water purification, or anything. He was merely trying to point out that if it were effluent of a plant, putting it through a clay and charcoal filter is an excellent job.

I don't think he needs me to apologize for him, but I would like you to read the letter as he intended it.

MR. TRYGG: I have two more comments.

I don't know what makes him a water supply expert. Maybe he is, but I think he is on the extreme end of it, on the extremely conservative end of this thing. I think you and I are in the middle.

I am not certainly the man who is going to say that anyone is going to be sick from eating this fish or drinking this water, but I certainly would like to know a little bit more about it, and I don't want to get on the other end where somebody says there is nothing to worry about, that this is fine, and this is what this man has said.

MR. MC ALLISTER: I didn't take it that way, and I still don't, in my own mind.

I think the man was just intending to carry out an experiment showing the high polarity of our natural soils to these chlorinated hydrocarbons, and the interesting thing is, although I haven't written this or put this all into the record, we have gotten a tremendous amount of data on mud samples all over the place, because on the basis of our views, one of the quickest ways to find out where there are possible sources of pollution, etc., is to look at the mud samples, because you are already half-way on your way to a chromatogram. It comes out in the mud.

There are some vagaries here which I would like to point out. I have to find out how fast the fish can get anything off the mud to consume it. I think it is a missing piece of data, and I would like to see it done.

I do know if we take the water samples that are over the mud, they are very low wherever we have collected it.

MR. STEIN: Mr. McAllister, again, we would like you to answer all the questions, but the difficulty with answering questions sometimes is that you open this up to these colloquies.

If you want an answer to that, we can call on Dr. Tarzwell and he can respond. Do you want to respond to that, Dr. Tarzwell?

DR. TARZWELL: I can give our data.

MR. MC ALLISTER: Before we do this, may I ask a question, Mr. Chairman?

MR. STEIN: Yes. The point is that if you mean rhetorical questions, that is all right, but if you are raising a question that you want an answer to, I think we are obliged to give the answer to the conferees.

MR. MC ALLISTER: I want to make two statements, if I can, and I would be glad to defer.

MR. STEIN: All right.

MR. MC ALLISTER: No. 1, I think we are trying to approach this and really find out some of the facts.

My present statement is just asking that question. We are going to try and answer it ourselves. So we want to do this because there are unanswered questions. I am going on with this investigation, and I think it is an extremely intellectual exercise.

In view of the statements made by the gentleman from Louisiana, I would suggest we strike Mr. Decker's letter entirely from the record and just rest it on our experiments, and I think that may be quite satisfactory. So, with your permission, we will just strike the letter entirely.

MR. STEIN: Without objection, that will be done.

MR. TRYGG: I would suggest you strike my comments along with it.

MR. STEIN: The record and the colloquy will --

MR. MC ALLISTER: I think I would prefer for my testimony to rest on my own evidence and my own statements.

Probably it was an error of judgment in introducing it. Certainly I didn't read it with the intention of offense.

MR. TRYGG: Incidentally, they are working on the same thing in Cincinnati, and they are very well aware of it. We are very much interested in it.

MR. MC ALLISTER: I will pass your remark back, and we will strike not only his part of it, but all references I made to Mr. Decker.

MR. STEIN: Fine.

Mr. Svore?

MR. SVORE: Mr. McAllister, the previous testimony we got indicated that Endrin was insoluble, and you referred to it as being soluble to the extent of 160 parts per billion.

Can you explain that?

MR. MC ALLISTER: No, I can't explain it. That is our data.

MR. SVORE: Thank you.

MR. MC ALLISTER: There are a lot of things I can't explain here, so please don't think I agree with everything that has been said.

MR. STEIN: I have another comment and I say this because I recognize there are different views --

MR. MC ALLISTER: May I say, sir, there is one little thing I would like to say?

Remember, it is 160 parts per billion, and that is one inch in two-thirds around the world.

Now, in terms of solubility, as chemists apply it, that is pretty insoluble.

MR. SVORE: I should comment, though, that we were talking about parts per trillion.

MR. MC ALLISTER: I don't remember the other statement, but when a person says a chlorinated hydrocarbon is insoluble, he is probably talking on reasonable solubility. We are working at fantastically low levels.

MR. STEIN: I think we can come to that other question you raised later, because I had that noted, but in the interests of saving time I think we should clarify something.

You said the Food and Drug Administration has already given us assurance that the fish and water are safe.

We have heard from the Food and Drug Administration. They are in our Department. I have worked very closely with them.

They are interested in the shipments of food in interstate commerce. I did not know that the Food and Drug Administration ever had any jurisdiction over water or indicated that water was safe or was unsafe.

MR. MC ALLISTER: Gentlemen, I am not such a fine -- I haven't the fine knowledge of the various jurisdictions of the various Government bureaus.

The statement I think I am referring to was made by Mr. Larrick in front of Senator Ribicoff.

MR. STEIN: Well, I think we can refresh our memory. We have that statement here.

As I recall Mr. Larrick's statement, Mr. Larrick was very careful to indicate that his jurisdiction extended to food going across a State line. It did not include food consumed intrastate. He certainly claimed no jurisdiction for water supplies, or water in the river. This is not meant to imply that any of that is not safe.

As I understood the statements of the people from the Public Health Service, they related to killing of certain fish, and are not necessarily a relation of danger to man.

Lastly, while I am talking, I would like to indicate that there is a statement in the last page of your paper which reads as follows:

> "There is some evidence that some fresh water fish have been killed by endrin, but, if so, this is most likely attributable to accidental spillage or intermittent contamination, not to normal agricultural run-off."

In the Velsicol statement we heard just recently, they said that Endrin is not the causative factor in the last Mississippi fish kill.

I don't ask for a comment.

MR. MC ALLISTER: No. I would like to point out that I said in my statement we have a certain number of samples of catfish, and then we have extrapolated very grossly.

I think the two statements might be reconciled by just what are we talking about in numbers.

I only offer that as an explanation, but it is my explanation. I certainly don't want to get involved in that conflict.

MR. STEIN: I have a comment, and perhaps Dr. Tarzwell can join here.

You made a point on this, and I certainly don't know the answer. Do you know whether Endrin absorbed into clay particles is harmful to fish?

MR. MC ALLISTER: I say in the mud is harmful to fish.

MR. STEIN: In the mud, or if it is absorbed in clay particles, in the river, as the river moves along, wherever it is, is that harmful to fish?

MR. MC ALLISTER: Well, of course, it is a matter of degree again. Some of the Endrin is put on dust, and that is clay.

What I am really trying to focus our attention on is the basic evidence, or the water above the mud in equilibrium is sufficient to kill fish. According to these figures, it was below the mortalities that the Taft Center said it was, and I think it is rather interesting.

I raised the question earlier as one of those unanswered questions, because I think there are a lot of them. I think that we in Shell are going to continue to pursue this matter. I think it is intriguing to our scientists, intriguing to me, and, furthermore, I think if it is a serious thing, why, then we ought to do something about it in the way of abating it.

I certainly have gone on record in Washington and in Baton Rouge and here again saying that it is extremely difficult, if not impossible, for me to see how putting, say, Dieldrin or those things on the soil under normal agricultural practice -- and I mean by that we know that there have been heavy rains at some times that caused trouble over in Atchafalaya -- but as normal practice, that this is accountable for continuing fish kills.

It could account, by misadventure or something, for periodic high kills, a lot of it all at once.

I think I can say that there is on record an incident where some airline pilot, as I recall, crashed a plane over in the Atchafalaya Basin. You probably remember it. The plane contained Endrin. I think it was the

Atchafalaya.

MR. STEIN: Will you talk louder, please?

MR. MC ALLISTER: I was just saying that there is on record where an airplane pilot cracked up a plane, and the contents of his spray tank went into the bayou and killed some crayfish.

I call that misadventure. I am sure he did not intend to do that.

MR. STEIN: Mr. McAllister, I would like to call your attention -- and I am sure you were here -- to the fact that when the conference first opened Mr. Biglane discussed this in his experiences in Louisiana. However, what Mr. Biglane was discussing was about normal operations and not misadventure. He said these seemed to be closely related:

> "1. Aerial applications of a pesticide named Endrin were being made on the cane fields.
>
> 2. Fish and other animal mortalities would occur soon after a rain followed by runoff from the cane fields.
>
> 3. Fish and animal mortalities ceased when aerial applications of Endrin ceased for the year."

This wasn't a crash he was talking about, I don't think.

MR. MC ALLISTER: Well, do you want a comment?

MR. STEIN: You can, surely.

MR. MC ALLISTER: Well, one of the interesting things is that after they quit actually spraying, at the point of application, then I would have said that the Endrin was bound in the soil and the fish kills stopped.

I don't find anything inconsistent there, but maybe I don't understand it too well.

MR. SVORE: I would like to ask another question.

MR. MC ALLISTER: Surely.

MR. SVORE: You are tying the Endrin up with the soil and with the silt, and it is going down the river and just passing through the fish gills. Do you feel that the Endrin can be removed from the soil as it passes through the gills?

MR. MC ALLISTER: You mean in the fish gills?

MR. SVORE: In the silt that is carried in the river. You indicated that it was tied up with the silt.

MR. MC ALLISTER: Yes, sir.

MR. SVORE: Not in the water in solution. Do the fish have the capacity again to remove the Endrin from the silt as it passes through the fish gills?

MR. MC ALLISTER: I am not an ichthyologist, and we are trying to get expert help and put on experiments in just exactly this field, as to how does the Endrin, if it is in the mud, get off of the mud and into the fish. I have here in my report probably -- I don't know how many the Department of Public Health has, but we have been analyzing mud and fish and fish viscera in order to prepare ourselves for this meeting and others, and we have an extensive amount of data now. It is on this data which is available -- and it is available to the press and to the conferees -- that we make these statements.

We are trying to do just as thorough a scientific job as we can do, but do remember, ladies and gentlemen, we only got notice of this problem somewhere in March. It is now early in May, and if you realize how terribly difficult it is to do these analyses and be sure your samples are all right, get your fish, ship them in, coordinate the data and write the report, I think you will realize that we have had a team of about thirty people working on this. It is still an unfinished study because we still have a lot of fish samples, mud samples, water samples, as yet unanalyzed, so we intend to see this thing through.

Just as long as there seems to be an argument and an unsettled question, we intend to go on with this investigation, and I would like again to offer that we will stand ready at any time to work with any responsible

Government agency or others in trying to solve this question. We will exchange samples, we will exchange analytical procedures, and, in fact, we might even exchange personnel, if necessary, to go to the two laboratories and find out if there is any cause for discrepancy.

There are some differences, but I think the picture is not too clouded at the moment.

MR. STEIN: Thank you, Mr. McAllister.

Are there any further comments or questions?

(No response.)

MR. MC ALLISTER: Thank you, gentlemen.

MR. STEIN: Thank you very much.

May I have your attention, please? We will recess for lunch for an hour and a quarter.

(Whereupon, at 12:30 p.m., the conference recessed until 1:45 p.m. of the same day.)